Mr. DULLES. We deeply appreciate that.

Mr. MANDELLA. Glad to have helped in any way.

Mr. DULLES. The Commission will stand adjourned until tomorrow morning at 9 o'clock.

(Whereupon, at 1:10 p.m., the President's Commission adjourned.)

Friday, April 3, 1964

TESTIMONY OF PAUL MORGAN STOMBAUGH AND JAMES C. CADIGAN

The President's Commission met at 9:10 a.m. on April 3, 1964, at 200 Maryland Avenue NE., Washington, D.C.

Present were Chief Justice Earl Warren, Chairman and Mr. Allen W. Dulles, member.

Also present were J. Lee Rankin, General Counsel; Melvin Aron Eisenberg, Assistant Counsel; and Charles Murray, Observer.

TESTIMONY OF PAUL MORGAN STOMBAUGH

The CHAIRMAN. The Commission will come to order. The purpose of today's hearing is to take the testimony of Paul Stombaugh and James C. Cadigan. Mr. Stombaugh is a hair and fiber expert with the FBI, and Mr. Cadigan is a questioned documents expert with the FBI. They have been asked to provide technical information to assist the Commission in its work.

This is just to advise you of the nature of the interrogation today.

Will you rise: Do you solemnly swear the testimony you are about to give before this Commission will be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. STOMBAUGH. I do.

The CHAIRMAN. You may be seated. Mr. Eisenberg, you may proceed with the examination.

Mr. EISENBERG. Mr. Stombaugh, could you state your full name and your position?

Mr. STOMBAUGH. Paul M., for Morgan, Stombaugh. I am a Special Agent of the Federal Bureau of Investigation, assigned to the hair and fiber unit of the FBI laboratory as a hair and fiber examiner.

Mr. EISENBERG. What is your education, Mr. Stombaugh?

Mr. STOMBAUGH. I have a Bachelor of Science degree in Biology from Furman University, Greenville, S.C., and I received a 1-year period of specialized training in the hair and fiber field in the laboratory under the supervision of the other experts.

Mr. EISENBERG. How long have you been in the hair and fiber field?

Mr. STOMBAUGH. Since 1960.

Mr. EISENBERG. Could you approximate the number of examinations you have made in this field?

Mr. STOMBAUGH. I have made several thousand hair examinations and about twice as many fiber examinations.

Mr. EISENBERG. Have you testified in court?

Mr. STOMBAUGH. Yes, sir; I have testified in approximately 28 States, both federal and local courts, as an expert.

Mr. EISENBERG. Mr. Chairman, I would like permission to examine the witness as an expert in this area.

The CHAIRMAN. The witness is qualified.

Mr. EISENBERG. Mr. Stombaugh, I now hand you Commission Exhibit No. 140, which for the record consists of a blanket which was found in the garage of Mr. and Mrs. Paine, and a piece of string marked Paine Exhibit No. 2, and I ask you whether you are familiar with these items?

Mr. STOMBAUGH. Yes, sir; I am. My mark is here on the blanket, and when this was received in the FBI laboratory this string was around a portion of it.

Mr. EISENBERG. Could you tell us what your mark is exactly, Mr. Stombaugh?

Mr. STOMBAUGH. Due to the fact this was a piece of fabric and hard to mark, I put a piece of evidence tape on the blanket, stapled it to the blanket, and put my initials "PMS" with the date 11-23-63 thereon.

Mr. EISENBERG. When did you receive this blanket, Mr. Stombaugh?

Mr. STOMBAUGH. This was approximately 7:30 a.m., on the morning of November 23, 1963.

Mr. EISENBERG. Can you describe the shape of the blanket and the position of the string, Paine Exhibit 2, when you received it?

Mr. STOMBAUGH. May I use this?

Mr. EISENBERG. What you are holding up is a piece of paper which—will you describe it, please?

Mr. STOMBAUGH. This is a piece of kraft paper approximately the same shape as this blanket. When I received the blanket, it had been folded together with both ends even; a slight triangle had been folded into one corner of the blanket, and another fold had been taken into the blanket thus.

Mr. EISENBERG. When you say "thus," you are folding the piece of kraft paper, and is the paper now folded into approximately—in a manner approximating the way the blanket was folded when you received it?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Mr. Chairman, may I have permission to introduce the piece of paper which the witness has so folded?

The CHAIRMAN. It may be so admitted.

Mr. EISENBERG. That will be Commission Exhibit 663.

(Commission Exhibit 663 was marked and received in evidence.)

Mr. EISENBERG. There is a safety pin inserted into Exhibit 663, Mr. Stombaugh. Was there an equivalent safety pin on the blanket?

Mr. STOMBAUGH. Yes, sir; there was a much larger safety pin attached to the blanket in approximately the same place as the small pin in the piece of paper.

Mr. EISENBERG. Now, the blanket is folded so as to approximate approximately a right angle triangle, and the safety pin is at one angle of that triangle opposite the right angle, is that correct?

Mr. STOMBAUGH. The safety pin would be at the vertex of the right angle——

Mr. EISENBERG. Now——

Mr. STOMBAUGH. Of the triangle.

Mr. EISENBERG. Were there any distinctive creases in the blanket?

Mr. STOMBAUGH. Yes; there were. There was one crease at the base, which would be the base of the right triangle, a very slight crease.

Mr. EISENBERG. Could you mark that with the letter "A" please, on the Exhibit 663?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. This is opposite—this is the side facing the angle at which the safety pin is inserted, is that correct?

Mr. STOMBAUGH. That is correct. It would be the base of the triangle.

Mr. EISENBERG. The base of the triangle——

Mr. STOMBAUGH. There was also another crease I found upon removing the safety pin and opening the blanket; I found that one end of the blanket had been folded in approximately 7 inches.

Mr. EISENBERG. What is the relationship between that and the end which you have just marked "A," is that the opposite side?

Mr. STOMBAUGH. That would be the opposite side of the blanket.

Mr. EISENBERG. Could you mark that "B"?

What was the relationship between the amount which the blanket was folded on the side "A" and the amount which it was folded on side "B," that is, were the folds approximately equal, or if different, how different, in length?

Mr. STOMBAUGH. The one, the fold marked "A" was not as great as the fold marked "B." The fold marked "B" was approximately 7 inches, the fold marked "A" was less than 7 inches.

Mr. EISENBERG. Proceed.

Mr. STOMBAUGH. There was one other crease in the blanket which was more or less a hump approximately 10 inches long, located approximately midway between the blanket, between—it is very difficult to describe the location.

Mr. EISENBERG. Could you point to it, and maybe we can describe it?

Mr. STOMBAUGH. Approximately in this area.

Mr. EISENBERG. This is, approximately midway between the side at which the fold marked "A" appears and the side at which the fold marked "B" appears?

Mr. STOMBAUGH. That is correct; approximately midway.

Mr. EISENBERG. Could you mark that fold or crease "C"? Was this a fold or a crease, Mr. Stombaugh?

Mr. STOMBAUGH. This was a very slight crease. It appeared as a hump in the blanket.

Mr. EISENBERG. Was there any item in the blanket, any object in the blanket, which might have been causing that hump?

Mr. STOMBAUGH. Not when I opened it, sir.

Mr. EISENBERG. Did you form an opinion as to what might cause that hump to exist in the blanket?

Mr. STOMBAUGH. Yes, sir; it would have had to have been a hard object, approximately 10 inches in length, which protruded upward, causing the yarns in the blanket to stretch in this area, and it would have had to have been tightly placed in the blanket to cause these yarns to stretch.

Mr. EISENBERG. Now, when you say the object was 10 inches long, do you mean that the object itself was 10 inches long or that there was an object 10 inches—an object protruding at a point 10 inches from the place you have marked "A"?

Mr. STOMBAUGH. No, sir; the object itself would have had to have been approximately 10 inches long to have caused this hump.

Mr. EISENBERG. It couldn't have been longer than 10 inches?

Mr. STOMBAUGH. Not at this point; no, sir.

Mr. EISENBERG. Could it have proceeded past that point marked "C," that is, could the object have been placed so that its base was at "C"—so that its base was at "A"? Is it possible that the object as it lay in the blanket passed "C" but with a protrusion at "C"?

Mr. STOMBAUGH. Yes, sir; this is quite possible.

Mr. EISENBERG. That is possible?

Mr. STOMBAUGH. This is quite possible.

Mr. EISENBERG. Were there any other folds or creases, Mr. Stombaugh?

Mr. STOMBAUGH. Yes, sir.

At the upper, call it the upper portion of the triangle, there were some creases in the blanket which had been caused by a piece of string which had been securely wrapped around the blanket at this point.

Mr. EISENBERG. Could you mark the area "D," where those creases occurred?

Is the string you are referring to the Paine Exhibit 2 which you earlier identified?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Was that wrapped around the blanket when you received it?

Mr. STOMBAUGH. Yes, sir; this was loosely wrapped around the blanket at this point. From an examination of the blanket itself and these creases, it was apparent that this string had been tied around the blanket while something was inside this blanket, and the string had been tied rather tight in order for these creases to have remained in the blanket.

Mr. EISENBERG. In other words, the creases remained in the blanket although there was no object in it when you received it——

Mr. STOMBAUGH. Correct.

Mr. EISENBERG. Which would account for the creases, is that correct?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And you therefore deduced there had been an object in the blanket preceding your examination?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Did you notice anything else about the blanket which you would like to relate, Mr. Stombaugh?

Mr. STOMBAUGH. The blanket exhibited much wear.

Mr. EISENBERG. We are just talking now about the shape, of course. We will be getting into composition later.

Mr. STOMBAUGH. No, sir; I cannot think of anything else at this time.

Mr. EISENBERG. In your opinion, would the blanket have made a secure package wrapped in the way and manner that it appeared to you?

Mr. STOMBAUGH. Yes, sir; it would have. With the crease at fold "A," had it been folded down, it would have made a very snug and secure package containing some type of item in it.

Mr. EISENBERG. Now, Mr. Stombaugh, was there anything about the string, Paine Exhibit 2, which would make an identification possible?

Mr. STOMBAUGH. No, sir; the string is just common white cotton string. It is found in most stores throughout the country, and used for, well, many uses. There is nothing distinctive about the string itself which could be traced as to manufacturer or any definite use it was made for.

Mr. EISENBERG. Any distinctive accidental markings on it?

Mr. STOMBAUGH. No; I found none.

Mr. EISENBERG. What kind—was it tied in a knot?

Mr. STOMBAUGH. Yes, sir; it was tied in a granny knot, and also a bow knot.

Mr. EISENBERG. Could you illustrate that for us? You are holding up a piece of string?

Mr. STOMBAUGH. This is another piece of string, not the original.

Mr. EISENBERG. Not the original.

Mr. STOMBAUGH. A granny knot is a common knot, tied with two simple thumb knots. It is a very hard knot to open as opposed to the boy scout knot, or the square knot rather, which is tied in this manner. This knot is very easy to open because all one has to do is to pull one free end of it and the other free end slides out.

Mr. EISENBERG. You are referring to the so-called "boy scout" knot?

Mr. STOMBAUGH. It is actually not a boy scout knot but a square knot.

Mr. EISENBERG. And you tie that left over right, right over left, is that the formula?

Mr. STOMBAUGH. Yes; left over right and right over left.

Mr. EISENBERG. How do you spell that, by the way?

Mr. STOMBAUGH. G-r-a-n-n-y.

Mr. EISENBERG. The granny knot, Mr. Stombaugh, is this a common or an uncommon knot?

Mr. STOMBAUGH. It is a very common knot. I believe that knot is tied more than any other knot because it is right over right, right over right, and it is usually used by people wrapping packages who want it tied securely so the package will not come open.

Mr. EISENBERG. Did you say there was also a bow knot?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. Could you illustrate that?

Mr. STOMBAUGH. This is the type of knot we use when we tie our shoe strings. It is made by forming a loop with the one free end, and wrapping the other free end around it and pulling it through.

Mr. EISENBERG. Is that a hard or an easy knot to slip out, Mr. Stombaugh?

Mr. STOMBAUGH. This is very easy, because you just take one of the loose ends and pull it and the knot falls apart.

Mr. EISENBERG. What was the relationship between the granny knot and the bow knot?

Mr. STOMBAUGH. I don't know. I have seen this numerous times, on numerous different occasions when one would either tie a granny knot or a square knot and follow it up with a bow knot. The granny knot would be to secure the package so it would not come loose. The bow knot is a temporary knot tied by one who wants the string to come off easily.

Now why they would tie a granny knot and follow this up with a bow knot I don't know, unless they had some long loose ends which they wanted to slacken up, shorten up, rather, so as they would not be hanging down.

Mr. EISENBERG. The Exhibit Paine No. 2 is tied into a knot at this point. Can you tell us what kind of a knot that is?

Mr. STOMBAUGH. This was a simple bow knot which I put into it.

Mr. EISENBERG. You put it into it?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. So the knot does not reproduce the knots as you found them originally?

Mr. STOMBAUGH. No; they do not.

Mr. EISENBERG. Mr. Stombaugh. I wonder if you could tie the demonstration piece of string you have been using into the granny knot and bow knot, in the manner in which you received it.

Mr. STOMBAUGH. There is the granny knot and here is the bow knot.

Mr. EISENBERG. You are not here trying to approximate the diameter or the circumference of the string, but only the knots?

Mr. STOMBAUGH. No.

Mr. EISENBERG. Mr. Chairman, may I admit this string as an illustrative exhibit?

The CHAIRMAN. It may be done.

Mr. EISENBERG. That will be 664, Mr. reporter.

(The item referred to was marked Commission Exhibit No. 664, and received into evidence.)

Now, Mr. Stombaugh, did you examine this blanket to determine its composition?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. Can you give us your conclusions?

Mr. STOMBAUGH. The blanket is composed of a very small percentage of brown and green woolen fibers; an average of about 30 percent to 40 percent of brown and green cotton fibers, and the remaining portion brown and green delustered viscose fibers.

Mr. EISENBERG. When you say "a very small portion of brown and green woolen fibers," could you be more specific; was it in the neighborhood of 1 percent or 10 percent?

Mr. STOMBAUGH. I was unable to obtain a definite percentage. This is a rather long, involved, and inaccurate method of determination because one would need a brand new blanket to get a good quantitative analysis.

However, in the samples of the fabric that I made, I found approximately 1 to 2 percent woolen fibers, 20 to, I would say, 30, 35 percent cotton fibers, and the remainder of it viscose fibers. This is just an approximation from the microscopic slide that I made.

Mr. EISENBERG. Would you have any reason to believe that the approximation was not made from a fair sample of the blanket?

Mr. STOMBAUGH. No; I wouldn't. I took the sample myself.

However, the blanket is very well worn. Most of the nap has been worn off of it. It has had a lot of use, and much of the original composition has been worn off. Now, whether or not this same percentage of composition is missing from use or not I wouldn't be able to determine, but I would say that the approximation that I had given is fairly accurate for the blanket in its present condition.

Mr. EISENBERG. Mr. Stombaugh, could you explain to us briefly how you were able to distinguish the three fibers, cotton, wool, and viscose?

Mr. STOMBAUGH. Yes, sir. This chart shows the difference in the textile fibers when one observes them under a microscope. A cotton fiber appears to be, or rather, might be compared with an ordinary soda straw which has been flattened. You can see here that the fiber is hollow. The hollow is known as the lumen in cotton. The fiber is flattened and twisted much as teen-agers do to soda straws in drug stores when they twist and crush the soda straws.

Mr. EISENBERG. Pardon me, Mr. Stombaugh: this chart is a chart labeled "Textile Fibers," and having three illustrations labeled "Cotton," "Wool," and "Viscose"?

Mr. STOMBAUGH. That is correct.

A woolen fiber actually is a hair which originates from an animal and is composed of three basic parts, the outer part being the scales which are the rough area on the outside of the hair, the inner portion known as the cortex, and a center portion known as the medulla. Microscopically this is what you would look for to identify wool.

Viscose is a synthetic fiber that is made by man. It is composed of chemicals, and is very rough around the outside area, having many striations running through it. The viscose fiber I have drawn here is what we would term a lustrous fiber. It does not have the delustering agent added to it, to cut down the luster. If this were a delustered fiber then we would have millions of small spots on the outside of this fiber which have been placed there chemically so as to cut down the luster of the fiber.

Mr. EISENBERG. Was the viscose in the blanket that we have been examining lustered or delustered?

Mr. STOMBAUGH. This was delustered.

Mr. EISENBERG. Mr. Chairman, may I introduce the chart which the witness has been discussing as 665?

This chart was prepared by you or under your supervision, Mr. Stombaugh?

Mr. STOMBAUGH. It was prepared by me.

The CHAIRMAN. What is the number?

Mr. EISENBERG. That will be 665.

(Commission Exhibit No. 665 was marked, and received in evidence.)

Mr. EISENBERG. Mr. Stombaugh, did you examine this blanket to determine whether any debris was present?

Mr. STOMBAUGH. Yes; I did. I scraped the blanket and removed all the foreign textile fibers and hairs and placed them into a pillbox.

Mr. EISENBERG. Can you describe to us how this scraping was performed?

Mr. STOMBAUGH. Yes, sir. We suspend the blanket from a rack in the laboratory, place a clean sheet of kraft paper on a table directly under it and, using a spatula, thoroughly scrape it down. This knocks all the foreign material adhering to the blanket from the blanket, and it falls down to the paper. After we have thoroughly cleaned the blanket, then we scrape up all the debris and place it in the pillboxes for a microscopic examination.

Mr. EISENBERG. Why do you use this scrape method, as opposed to a fine-filter vacuum cleaner?

Mr. STOMBAUGH. We have found that the fine-filtered vacuum cleaner pulls all of the dirt and old debris from a blanket which are embedded on the inner portion of the fabric. We are not interested in this material. We are interested only in what is adhering to the top surface, which has been put there most recently. Through experience in the laboratory we have found this method to be the best so far.

Mr. EISENBERG. So that by use of the scrape you gathered the more recent debris, as opposed to the older debris?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And what type of debris did you find, Mr. Stombaugh?

Mr. STOMBAUGH. I found numerous foreign textile fibers of various types and colors, as well as a number of limb and pubic hairs.

Mr. EISENBERG. Did you draw any conclusions as to those hairs upon your initial examination of them?

Mr. STOMBAUGH. Yes; I did. They all had originated from a person of the Caucasian race and I compared these hairs with hair samples obtained from Harvey Oswald——

Mr. EISENBERG. That is Lee Harvey Oswald?

Mr. STOMBAUGH. That is, Lee Harvey Oswald, and I found that of the limb and pubic hairs I removed from the blanket, several matched Oswald's in all observable microscopic characteristics and could have originated from Oswald.

Mr. EISENBERG. You said these hairs were from a person of Caucasian race. Can you explain how you can tell the difference between hairs of the various types of races?

Mr. STOMBAUGH. Yes, sir. Going back to my charts, I have a chart here which contains a diagram of a hair. This isn't any particular hair, this is a type of hair that could be animal or human. I am just using this to give one an idea of what a hair looks like.

First, we have the root, which is the portion of the hair embedded in the scalp or in the skin, whichever type hair it might be.

(At this point, Mr. Dulles entered the hearing room.)

Mr. STOMBAUGH. And from the root, extending out and growing, is the shaft of the hair, and the very distal end of that is the tip.

If we were to take this hair and place it under a microscope, this is what we would see. We find that the hair basically consists, in the shaft area, of scales composing the outside portion of the hair. Directly under the scales is the cortex. Now the scales vary in size and shape among animal and human hairs. The cortex also varies. Running through the center of the hair shaft, much as the lead in the center of a lead pencil, is what is known as the medulla.

The medulla is nothing more than air cells running through the center of the hairshaft.

In the cortex of the hair are small granules which appear under a microscope like tiny grains of sand. These are known as the hair pigment. This is the part of the hair that gives the hair its color, whether it is blond, dark brown, black, or what-have-you.

Also present in the cortex you will occasionally find air spaces located among the pigment granules which are known as cortical fusi. These will vary in size, shape, form, and location on the hair. Many hairs do not have any.

Basically that is what a hair looks like, and the basic component parts of the hair.

Mr. EISENBERG. May I have this admitted as 666, this diagram of the hair?

The CHAIRMAN. Yes; it may be admitted.

(Commission Exhibit No. 666 was marked, and received in evidence.)

Mr. STOMBAUGH. Now, keeping the diagram of the hair on the side where we can refer to it, our first differentiation in the hair, of course, would be separating the human from the animal hairs. These are photomicrographs of human hairs which I took through a microscope.

Here are the animal hairs.

The first thing we look for, of course, would be the color, length, and texture of the hair. This comes from experience from looking at thousands of hairs, and we can usually pick one up and tell by the naked eye whether it is animal or human.

Mr. EISENBERG. Pardon me. You are referring to a chart which has on the upper right, "Human Hairs" and on the upper left, "Animal Hairs" as captions?

Mr. STOMBAUGH. That is correct.

However, when we place these hairs under a microscope we find that animal hairs vary from human hairs in many different aspects.

One, the medullary structure. In animal hair the medullary structure is much wider than that in a human hair. You will find that it exceeds more than one-third of the width of the hair shaft.

Secondly, the shape of the medulla, as in this rabbit hair, varies greatly. You can see the individual medullary cells very distinctly. In this chart I have some photographs of human hairs in which a medulla is not present. But the medulla in a human hair would look just about like this, very thin.

We move down to the pigmentation of the hair, which is located in the cortex. In the human hair the pigmentation is very fine and granular, and in this animal hair it is very coarse and elongated.

The size and shape of a root on the animal hair differs from the size and shape of the root in the human hair. Here we see the root of a dog hair which is very long and very thin. The root of a human hair is more or less shaped similar to a light bulb. The scales of animal hairs are very large. The scales of the human hairs are much smaller.

Mr. EISENBERG. Mr. Chairman, may I have this chart which the witness has been using introduced as 667?

The CHAIRMAN. It may be admitted.

(The chart referred to was marked Commission Exhibit No. 667, and received in evidence.)

Mr. EISENBERG. You are looking at a new chart called "Racial Determination of Hairs" with the subcaption "General Appearance of Shaft"?

Mr. STOMBAUGH. That is correct.

Once we have separated the animal hairs from the human hairs, our next problem is determining the race of the individual from whom the particular human hairs in which we are interested originated.

Looking at the hair under low power—under a low-power microscope—we find that a Caucasian hair differs from the hair of the Negroid or Mongoloid race in diameter fluctuation. The hair shaft varies in width through its entire length. I might take, for instance, this yellow or this black pencil. Here we find that the diameter of the pencil is uniform through the entire length. Now, if we would twist this pencil we would change the diameter of the pencil slightly. This would be so in a Caucasian hair, where there might be slight fluctuations in a hair, such as a person with wavy hair would have a slight fluctuation. The person with straight hair has hair shafts which for all practical purposes, are uniform in diameter the entire length.

In Negroid hair, there is great fluctuation. Their hair is very curly and kinky. This is caused by the great fluctuation present in their hairs.

Mr. EISENBERG. You mean in the diameters?

Mr. STOMBAUGH. Yes; diameters.

In Mongoloid hair, which includes Asiatic and North American Indians, there is little or no fluctuation present in their hairs.

Going back to the Caucasian hair, the color of the Caucasian individual's hair differs from black to blond and, of course, white.

Negroid hairs are dense black usually; some are white. There are a few exceptions here where we find some redheaded persons of this race. The Mongoloids are always black, but not quite as dense black as those of the Negroid race.

The texture of the hair: Caucasian head hairs, are very soft, flexible; Negroid hairs are very stiff and wiry; and Mongoloid hairs are flexible, but not as soft and flexible as the Caucasian.

Now, as to the general width, or rather diameter, of the shaft, we find Caucasian is medium, the Negroid is medium, the Mongoloid hairs are much larger than either the Negroid or the Caucasian.

Mr. EISENBERG. May I have this chart which the witness has been discussing marked as 668, Mr. Chairman?

The CHAIRMAN. Yes.

(Commission's Exhibit No. 668 was marked, and received in evidence.)

The CHAIRMAN. May we take a recess at this time just for a few moments.

(Short recess.)

Mr. DULLES. Mr. Eisenberg, would you proceed?

Mr. EISENBERG. Yes, sir. Mr. Stombaugh, you were discussing the characteristics of Caucasian as opposed to Negroid and Mongoloid hair. Could you proceed with that discussion?

Mr. STOMBAUGH. I have another chart here.

Mr. EISENBERG. That is labeled "Racial Determination of Hairs" and unlike chart 668 it has no subcaption under that general caption, is that correct?

Mr. STOMBAUGH. That is correct. In the previous chart I used I had taken some photographs of hairs under relatively low power, 100 diameters.

In this chart I have enlarged the hairs, taking them under approximately 400 diameters, so we can look into the hair. Here we begin to see the real differences between the hairs among the various races.

In the Caucasian race, the cuticle, in other words, the layer of scales around the outside of the hair, is medium to thick.

In the Negroid hair the cuticle is very thick. In the Mongoloid hair the cuticle is very thick.

Pigmentation in the cortex, which gives the hair the color, in Caucasian hair is very fine to coarse and is very evenly distributed throughout the cortex of the hair. In Negroid hair the pigment is medium to coarse, but the big difference is that the pigment granules are clumped together, leaving large white-gapped areas throughout the cortex of the hair.

In the Mongoloid hair, the pigment is medium to coarse but it is very heavily distributed throughout the hair. As you can see, in the Caucasian hair the cortex is relatively light. In Negroid hair it is clumped, and in Mongoloid hair it is dense.

Mr. EISENBERG. Mr. Chairman, may I have this chart admitted as 669?

Mr. DULLES. It is admitted as 669.

(Commission Exhibit No. 669 was marked, and received in evidence.)

Mr. EISENBERG. You have a chart here "Racial Determination of Hairs," and no subcaption, is that right?

Mr. DULLES. You haven't asked for this other to be admitted, have you?

Mr. EISENBERG. No; I will ask after he has finished with it.

Mr. STOMBAUGH. Occasionally we will run into situations in hairs, where we cannot determine with any certainty whether or not the hairs are of the Caucasian or Negroid or Mongoloid race, by examining it longitudinally, and we have to make a cross-section of the hair. If we make a cross-section of the hair it is the same as taking a banana and cutting off a very thin slice of the banana and placing it under a microscope and examining it. We find in the Caucasian race the hairs are oval in shape. In the Negroid race the hairs are flat, and have a flattened appearance, and in the Mongoloid race they are perfectly round. This is another characteristic which we use in determining the racial origin of hair.

Mr. EISENBERG. May I have this chart admitted as 670?

Mr. DULLES. Yes.

(Commission Exhibit No. 670 was marked, and received in evidence.)

Mr. EISENBERG. Was it definitely established in your mind as a result of the various characteristics you have explained that the hairs found in the blanket were Caucasian hairs?

Mr. STOMBAUGH. Yes, sir; they were all Caucasian hairs.

Mr. EISENBERG. Did you examine those hairs and compare them with any known samples to determine whether they might have come from any specific individual?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. What was your conclusion on that score?

Mr. STOMBAUGH. I examined the hairs found on the blanket and determined that most of them were limb and pubic hairs. In other words, they originated either from the leg or the arm or from the pubic area. I found several head hairs on the blanket also.

These hairs I compared with known hair samples from Lee Harvey Oswald. I found several of the limb hairs from the blanket and several of the pubic hairs from the blanket matched in all observable microscopic characteristics, and concluded these hairs could have come from Oswald.

Mr. EISENBERG. Where did you get the known sample, Mr. Stombaugh, of Lee Oswald's hair?

Mr. STOMBAUGH. These were obtained and were sent to the laboratory by the FBI office in Dallas.

I do not know whether the agent in Dallas personally took the samples or had a member of the Dallas Police Department take the samples.

Mr. EISENBERG. Were these hairs taken from one area or were they a representative sample?

Mr. STOMBAUGH. It was a fairly good representative sample.

Mr. EISENBERG. Could you review the microscopic characteristics which led you to your conclusion, Mr. Stombaugh?

Mr. STOMBAUGH. This chart contains a photomicrograph of Oswald's pubic hairs. This is just a very small area taken of a glass microscope slide containing the hairs. There were numerous other hairs. The photograph on the right shows one of the hairs I removed from the blanket, and one of the hairs from Oswald, showing, generally, the match.

Mr. EISENBERG. Now, did you take these photographs on the left and right side yourself?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. This chart is captioned on the left "Photomicrograph of Oswald's Pubic Hairs" and on the right "Hair from the Blanket" and "Hair from Oswald"?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. May I have it admitted?

(The item referred to was marked as Commission Exhibit No. 672, and received into evidence.)

Mr. DULLES. May I ask a question? The one on the right seems darker than the one on the left, the hair itself.

Mr. STOMBAUGH. This one and this one?

Mr. DULLES. What is it?

Mr. STOMBAUGH. Are you referring——

Mr. EISENBERG. The hair shown on the right appears darker.

Mr. DULLES. There are two specimens there or two——

Mr. STOMBAUGH. Two.

Mr. DULLES. That is what I thought.

Mr. STOMBAUGH. You are thinking this hair looks darker than this one?

Mr. DULLES. No; I was thinking that both the hairs on the right, which I understand were taken from Oswald——

Mr. EISENBERG. One hair was actually from the blanket, one from Oswald.

Mr. DULLES. Seems darker than the ones taken from the blanket. Is the left the blanket?

Mr. STOMBAUGH. This portion here is one separate hair. This was taken from the blanket.

Mr. DULLES. That was taken from the blanket. The right-hand is taken from the blanket and the left-hand hairs were taken from Oswald himself?

Mr. STOMBAUGH. Yes, sir; these are from Oswald.

Mr. DULLES. Yes.

Mr. STOMBAUGH. This is a comparison shot. This photograph was taken through two microscopes simultaneously showing how this portion of a pubic hair from the blanket matched a pubic hair from Oswald, which is this portion of the photograph.

Mr. EISENBERG. You are pointing to the right side of the chart 672?

Mr. STOMBAUGH. Yes; this photograph was taken at 100 diameters and this photograph was taken at 400 diameters. There is a difference there also.

Mr. EISENBERG. Could you state that again please?

Mr. STOMBAUGH. The photograph on the left was taken approximately at 100 diameters.

Mr. EISENBERG. That is Oswald's pubic hairs, a known sample?

Mr. STOMBAUGH. Yes; this is a general shot of his known sample.

Mr. EISENBERG. And the one on the right?

Mr. STOMBAUGH. The one on the right was taken at approximately 400 diameters.

Mr. DULLES. This is the blanket sample?

Mr. STOMBAUGH. This is a hair from the blanket compared with Oswald's.

Mr. EISENBERG. You have three photographs on this chart, of which two are known Oswald hairs, the photograph on the left and one of the two photographs on the right?

Mr. STOMBAUGH. Actually, this is one photograph taken through a comparison microscope. We are looking at two different hairs at the same time.

Mr. EISENBERG. Yes. Well, when you say this is one photograph you are pointing to the one on the right but, as I understand it, the photograph on the right shows two different hairs?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. One of which is Oswald's hair, a known sample?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. And the other of which was obtained from the blanket?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. And the photograph on the left shows known samples of Oswald's pubic hairs?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. So we have in effect two views of Oswald's pubic hairs, one on the left and one half of the composite photograph on the right?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. Following up on Mr. Dulles' question, the photograph on the right seems to have a much coarser and somewhat darker structure in both the known and the questioned sample than the photograph on the left, which is simply a known sample.

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And you said that was because of the enlargement?

Mr. STOMBAUGH. The difference in the enlargement. The photograph on the left was taken with the microscope set to magnify the specimen 100 times. The

photograph on the right was taken with the microscope set to magnify the specimen 400 times.

Mr. EISENBERG. The photograph on the right does not seem to show a hair four times larger, so I don't understand it.

Mr. STOMBAUGH. It was on the enlarging of the photograph itself.

Had these two prints been enlarged at the same enlarging factor, the hairs on the left, would be much, much smaller than the ones on the right. This was just blown up to this size so the hairs could be seen.

For instance, had we not blown these up, here we see them magnified 400 times, and this other photograph is a natural shot.

Mr. EISENBERG. Now, here you are pointing to photograph 669, and the second shot which you call "natural" is 668?

Mr. STOMBAUGH. Yes, sir. You can see the difference in the diameter and the difference in the detail of the photograph.

Mr. EISENBERG. Were those photographs of different magnifications?

Mr. STOMBAUGH. Yes; they were.

Mr. EISENBERG. What was 669, do you recall?

Mr. STOMBAUGH. I believe it was approximately 400.

Mr. EISENBERG. And 668?

Mr. STOMBAUGH. Approximately 100.

Mr. EISENBERG. So it corresponds to the difference in the right- and left-hand portions of 672?

Mr. STOMBAUGH. Yes; it would.

Now, the characteristics we look for in making a hair match. First would be the color.

The matches I found in Oswald's hairs. His hairs vary from light brown to a medium brown shade.

Mr. EISENBERG. Are you talking about the known samples now?

Mr. STOMBAUGH. This is his known sample. In this particular match the color was medium brown, and looking at the hair throughout its entire length, it ranged from a medium brown, and this color remained constant to the tip, where the color changed to a light brown and the very tip of it was transparent, it was clear, had no color at all. There were no color pigments in the tip of the hair.

Mr. EISENBERG. Are you referring now to the pubic hair which you illustrate on the right-hand side of 672?

Mr. STOMBAUGH. Yes; I am referring to the pubic hair.

This is the gross appearance. I looked at it under low power where I could see the entire length of the hair.

Next, the thickness of the hair, or the diameter of the hair shaft. I found this diameter to be rather narrow for pubic hairs. Pubic hairs ordinarily are rather thick. Oswald's hairs were relatively narrow. Pubic hairs also have what we term nobbiness. You can see a nob right here, it is twisted——

Mr. EISENBERG. Could you circle that with a pen, and mark it "A" on chart 672?

Mr. STOMBAUGH. Here we see that it twists and it is very uneven. The shaft of the hair is generally very uneven in pubic hairs.

However, in Oswald's pubic hairs we had very little of this. The hairs were very smooth. They lacked this nobbiness. The upper two-thirds were extremely smooth for pubic hairs. This was an unusual characteristic.

The tips of Oswald's pubic hairs were not worn. They had a very sharp tip and very clear. Ordinarily pubic hairs are rounded at the tips, and not pointed—this is from wearing against clothing—at all. This would indicate to me that his pubic hairs were rather strong, much tougher than the average persons.

The cuticle, in other words the very thin layer of scales covering his hairs, is very thin for pubic hairs. The scales exhibited a very small protrusion on the outside. The distance they protruded from the shaft of the hair is very slight.

Mr. EISENBERG. When you talk about the protrusion, do you mean the distance between the point of the scale and the balance of the cuticle, the center of the cuticle?

Mr. STOMBAUGH. That is correct. Some hairs will have a sawtooth effect, will look just like saw teeth do when you look at the blade of a saw.

Mr. EISENBERG. From the protrusion of the scales?

Mr. STOMBAUGH. From the protrusion of the scales. Others will be very small, have a slight protrusion.

Mr. EISENBERG. How was Oswald's?

Mr. STOMBAUGH. It was a very small protrusion. The gapping of Oswald's hair was very slight. In other words, between the cuticle and the cortex, the cortex of course containing the color pigment in the hair, occasionally you will find hairs where there will be no color pigment in areas up near the cuticle. There will be a gap there.

Oswald's hairs, as you can see here, have some gapped areas in there but not too many. They are very irregular, and the gapping does not go down too deeply into the cortex.

Pigmentation of his hairs was very fine, equally dispersed, and there was some chaining together of the larger pigment granules noted. In other words, three or four of the pigment granules were chained together. Instead of being dispersed such as they are in Exhibit No. 666, you would have five or six of them chained together, forming a slight irregular-appearing streak.

Cortical fusi, the air spaces present in the hairs such as I have drawn here on Exhibit 666, were for the most part absent in his hairs. I found very, very few of them, and would term them absent in his hairs.

The medulla in the hairs, those that contained a medulla, was constant. It was a continuous streak for the most part. There were some slight broken areas in it. The hairs of Oswald, that did not have a medulla, there was not a trace of one present. It was completely absent. This is unusual. Usually, you will find that the hairs will contain a medulla and if not in the ones that appear not to, you can find traces of a medulla present. In his I didn't find any medulla at all in several of the hairs.

The root area of his hairs was rather clear of pigment and there was only a fair amount of cortical fusi present. As in drawing No. 666, in the root area, you ordinarily would find a large amount of cortical fusi which rapidly diminish as you proceed out the hair shaft, and in his there was just a relatively few cortical fusi in the root area. I found this characteristic also in some of the hairs removed from the blanket.

Basically, that is the—those are the characteristics I used in matching Oswald's pubic hairs with pubic hairs from the blanket.

Mr. EISENBERG. You have been discussing the characteristics of Oswald's pubic hairs. In each case were the characteristics of the pubic hairs you found in the blanket the same as those you have noted as being present in Oswald's pubic hairs?

Mr. STOMBAUGH. Yes, sir; they were all identical.

Mr. EISENBERG. That is as to protrusion of scale, absence of cortical fusi, chaining together to some extent of pigments, and so forth?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Without going through every item, every item you have named was identical?

Mr. STOMBAUGH. Every item I have found in hair from the blanket?

Mr. EISENBERG. Yes, sir.

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. Could you go on, please?

Mr. DULLES. Just one second, off the record.

(Discussion off the record.)

Mr. DULLES. Back on the record.

Mr. EISENBERG. You have presented at this point a chart labeled "Microphotograph of Oswald's Limb Hairs" on the left, and on the right two subcaptions, "Hair from Blanket" and "Hair from Oswald," and do these—were these photographs taken by you or under your supervision?

Mr. STOMBAUGH. They were taken by me.

Mr. EISENBERG. Are they accurate reproductions of the material which according to the captions they are photographs of?

Mr. STOMBAUGH. Yes; they are.

Mr. EISENBERG. I would like this admitted as 671, Mr. Chairman.

Mr. DULLES. It will be admitted as 671.

(Commission Exhibit No. 671 was marked, and received in evidence.)

Mr. EISENBERG. Could you briefly discuss this exhibit?

Mr. STOMBAUGH. Exhibit 671 is similar to Exhibit 672 in that both contain two photographs. The photograph on the left is an overall shot of Oswald's limb hairs.

Mr. EISENBERG. That is the known?

Mr. STOMBAUGH. That is the known from Oswald.

The photograph on the right contains photographs of two hairs, in this same photograph, the hair on the right being a limb hair from Oswald, and the hair on the left being a hair removed from the blanket.

Mr. EISENBERG. What is the magnification there, Mr. Stombaugh?

Mr. STOMBAUGH. The magnification of these is approximately the same as in the previous submission, the one on the right being approximately 400 diameters and the one on the left 100 diameters.

Now, the one on the right is a limb hair. A limb hair is much smaller in diameter than a pubic hair. That is why there will appear to be some slight change in the size of these hairs.

I compared the limb hair from the blanket with the limb hair from Oswald which matched in all observable microscopic characteristics. The characteristics I found in this match were the color of the hair was light brown through its entire length, and the width of the hair shaft or the diameter was very fine. There was no fluctuation that one could readily see. The diameter of the hair shaft remained constant to the tip, where it diminished down to a point.

The tips of the hairs were very sharp and no abrasion was noted. In other words, the tips of these limb hairs were not rounded as one ordinarily finds. This would indicate the hairs were very tough, the same as the pubic hairs were.

Mr. EISENBERG. Are you describing now the known hairs?

Mr. STOMBAUGH. These are known hairs and the match I made; both.

Mr. EISENBERG. All right.

Mr. STOMBAUGH. The scales were of medium size, had very slight protrustion, and there was very slight gapping in the pigmentation located in the cortex right against the cuticle of the hair. There was a fair amount of cortical fusi equally distributed throughout the hair shaft.

This is not unusual in itself, but the amount of cortical fusi that I did find present is unusual.

The medulla was discontinuous, granular, very bulbous, and very uneven. It was not a constant, smooth straight line such as one might find over here in this pubic hair on 672.

There was nothing unusual noted about the root area of these hairs.

Mr. EISENBERG. And again you are describing the characteristics of both hairs, and they were identical in all these characteristics?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Were there any characteristics in which they were not identical?

Mr. STOMBAUGH. No; not on the limb hair, as I found it matched. I did find limb hairs and pubic hairs and head hairs in this blanket which were dissimilar to Oswald's and definitely did not come from him but the hairs I have talked about here matched in all microscopical characteristics.

Mr. EISENBERG. The other hairs, Mr. Stombaugh, could you make a determination as to race?

Mr. STOMBAUGH. Yes; they were all Caucasian.

Mr. EISENBERG. Could you make a determination as to sex or age?

Mr. STOMBAUGH. No; it is not possible to determine sex or age from an examination of a hair.

Mr. EISENBERG. Could you make a determination as to the number of individuals who had contributed these hairs?

Mr. STOMBAUGH. No; I couldn't. You would have to have a hair sample from any suspected person, and hairs vary tremendously. Even on the same individual head hairs from the same individual can vary from one head area to another.

I have found as many as 12 to 15 different types of hair on the same person's head.

So, therefore, it would not be possible to estimate the number of different people whose hairs have appeared on this blanket.

Mr. EISENBERG. Now, Mr. Stombaugh, are you able to say that the limb hairs and pubic hairs which you found in the blanket and which you have matched with Oswald's in observable microscopic characteristics came from Oswald to the exclusion of any other individual?

Mr. STOMBAUGH. No; I couldn't say that. I could say that these hairs could have come from Oswald. I could not say they definitely came from him to the exclusion of all other Caucasian persons in the world.

In order to say this, one would have to take hair samples from all of these people and compare them and this, of course, is impossible.

Mr. EISENBERG. What degree of probability do you think there is that these hairs came from Oswald? And without putting a precise number on it, let's suppose you took head hairs from 100 Caucasion individuals, how many matches would you expect to find among those hundred different hairs on the basis of your experience?

Mr. STOMBAUGH. On the basis of my experience I would expect to find only one match.

Mr. EISENBERG. That is to say that the 100 hairs would be different from each other?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. Is your experience, therefore, that the hairs of different individuals do not match in observable microscopic characteristics—within the basis of your experience?

Mr. STOMBAUGH. Within the basis of my experience, I have examined thousands of hairs and I have never found Caucasian hairs from two different individuals that match.

Mr. EISENBERG. Now, when you say that, Mr. Stombaugh, have you been presented with hairs in your laboratory from Caucasian individuals which you knew before the examination came from two or more individuals?

Mr. STOMBAUGH. Yes.

We have obtained samples of hairs from a hundred different people, and would select one hair, give it to an examiner and ask who it originated from, and invariably he would be able to find in the hundred different samples the individual the hair originated from.

Mr. EISENBERG. Now, when a specimen comes into your laboratory, does it frequently come in—and I am talking now about specimens that come in from a crime—does it frequently come in such, so that you have two specimens, two or more specimens, which you know before you begin are from two different people?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. You are told before you begin that they come from two different people?

Mr. STOMBAUGH. Yes, sir; ordinarily a case such as a murder or a rape, you will obtain the clothing of the victim, the clothing of the suspect in the case, as well as hair samples from the victim and hair samples from the suspect.

Mr. EISENBERG. How many types of cases like this do you think you have processed?

Mr. STOMBAUGH. Processed approximately 500 a year.

Mr. EISENBERG. For how many years?

Mr. STOMBAUGH. Four years—no, three years.

Mr. EISENBERG. In any of these approximately 1,500 cases, have you found a case involving Caucasian hairs in which the hairs from the known two different individuals matched in observable physical characteristics microscopically?

Mr. STOMBAUGH. No, sir; I have never found hair from two different Caucasian persons that matched.

Mr. EISENBERG. Have you found any in non-Caucasian hairs, by the way?

Mr. STOMBAUGH. I have found several cases in which hairs from two different persons of the Negroid race, although the hairs did not match completely, the characteristics were such that I felt that I could not go further with the examination because I could not exclude the hairs. The hairs were too similar. When

I make a hair match, I know that any case might go to court, and of course I want to be absolutely certain in my mind.

In these cases I am referring to right now, the hair sample from the victim and the hair sample from the suspect were pubic hairs. They were so similar to each other that I could not find any pubic hairs that I could match with the suspect's pubic hairs, and be certain in my mind that these hairs came from him rather than her. I couldn't do this.

So, therefore, I sent the evidence back without further conclusion. This has happened in approximately three cases. However, I would like to point out that I could not take his, the suspect's pubic hairs, and the victim's pubic hairs and completely match them up under a microscope slide such as the match shown in the chart. They did not absolutely match, but they were too similar for a good determination to be made.

Mr. EISENBERG. What proportion of the 1,500 cases that you have described—approximately 1,500 cases—have involved Negroid as opposed to Caucasian hairs, just roughly?

Mr. STOMBAUGH. I would say about approximately a third. Of course, a lot of these cases we don't know the race. They don't list the race, but in examining the hairs I can tell the race——

Mr. EISENBERG. So in 1,000-odd cases of the Caucasian hair examinations you haven't 2 matches between hairs from different individuals?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And in the 500-odd cases of Negroid, 500-odd cases involving hairs from two different Negroid individuals, you have found three cases where although the hairs were not identical they were so close that you felt you didn't want to go further in your examination, is that correct?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. Is that a fair recapitulation?

Mr. STOMBAUGH. Yes.

Mr. DULLES. Could I just ask a question here?

There is a distinction then, as I gather from your testimony, an understandable one, between the comparison of hairs and, say, the comparison of fingerprints, because obviously the hair that you find on the victim has left the assailant and, therefore, you are not looking at the same hair but you are looking at a different hair?

Mr. STOMBAUGH. That is correct.

Mr. DULLES And that, therefore, distinguishes testimony in regard to hair, we will say, with regard to fingerprint examination?

Mr. STOMBAUGH. Yes, sir; that, and also a fingerprint will remain the same throughout one's life. It will never change. A hair will.

Mr. DULLES. I see.

Mr. STOMBAUGH. You can see my hair, I am starting to get white at the temples. Mine is changing characteristics.

Mr. DULLES. We all do.

But is there—let's say you examine 100 hairs, let's say, that are found on the victim, and 100 hairs that are different hairs that are found on the assailant; let us say that there are certain characteristics common to all of these hairs.

Do you get my question? Let's say 10, not 100, whatever number you want to take.

Mr. STOMBAUGH. Ordinarily, you would find one or two.

Mr. DULLES. That have certain characteristics. You have pointed out on exhibit—on the left-hand side of Exhibit 672, the circle you have made on 672, circle A.

Is there a common characteristic that you have marked on one of the other hairs? I believe the hair marked with the "A," was taken from Oswald himself, the hair on which you have marked that particular characteristic.

Is there any corresponding characteristic that should be marked or indicated on a hair that was found on the blanket?

Mr. STOMBAUGH. Well, I testified as to all the characteristics I found.

Mr. DULLES. Yes.

Mr. STOMBAUGH. Now, the difficulty in using a photomicrograph, you are

trying to photograph a round object and as a result of this all of these characteristics just won't appear in focus.

Mr. EISENBERG. To be more specific, Mr. Stombaugh, that circle marked "A" was to show a nobbiness in Oswald's hair. As I recall, you testified there was very little nobbiness present in that pubic hair, as opposed to the normal amount of nobbiness of pubic hair?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. On the right-hand side of 672, I suppose we don't see much or any nobbiness in either the known or——

Mr. STOMBAUGH. No; there is none present here.

Mr. EISENBERG. So that would correspond with the point you made as to "A," that there was very little nobbiness?

Mr. STOMBAUGH. Very little.

Mr. EISENBERG. And that is why there is no corresponding mark for nobbiness characteristic on the right-hand side, is that correct?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. The right-hand side of 672?

Mr. STOMBAUGH. That is correct. Oswald's hairs, where the nobbiness did appear was in the lower third, in other words, the area from the root out on the shaft approximately one-third. The remaining two-thirds of the hair shaft all the way out to the tip was relatively straight, no nobbiness at all present. This was characteristic. Ordinarily a pubic hair will have this nobbiness two-thirds to three-fourths of the way up. So this was a characteristic which exists in Oswald's pubic hairs which is different from the ordinary or average.

Mr. DULLES. And you found that both on the hairs taken from Oswald himself and on the hairs found in the blanket?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. Mr. Stombaugh, on this general point, when you make your comparison examination, do you come to your conclusions on the basis of what you see under the microscope, or on the basis of the photographs you take?

Mr. STOMBAUGH. On the basis of what I see under the microscope.

Mr. EISENBERG. Do you usually take photographs?

Mr. STOMBAUGH. No, sir.

Mr. EISENBERG. And you took them—can you explain why you took them here?

Mr. STOMBAUGH. I took these at your request as an exhibit just to show what the hairs looked like. In a photograph it is very hard to try to point out the characteristics of hairs because they aren't clear. Under a microscope you can see each of these points by focusing up and down. If I am looking at the pigment on the hair, I can focus the comparison microscope up and down and see exactly the same characteristics, the pigment is exactly the same size, dispersed about the same, and there is approximately the same amount of pigment in a given area.

Also, the cuticle is of the same thickness. I can line the hairs up longitudinally and see that the tips of the scales match equally as far as protrusion and distance goes.

This you couldn't show in the photographs. In order to show each and every characteristic in photographs, I would have to take 500 or 600 different photographs.

Mr. EISENBERG. So these photographs are just as a general illustration of the kind of thing you see, rather than being given to the Commission as photographs from which the Commission is to make an identification?

Mr. STOMBAUGH. That is correct. If I were to look at these photographs myself, I couldn't make an identification on them because I wouldn't be able to see enough and I would say this looks like this and this looks like this, but so what?

What about the size of the pigments, what about the size of the scales, what about the thickness of the cuticle? I see a medulla here, I don't see a medulla over here. So you just couldn't see all the characteristics in a photograph.

Mr. EISENBERG. But these characteristics you do see as you change the focus on the microscope?

Mr. STOMBAUGH. Yes; these appear by looking through different areas of the hair shaft itself.

Mr. EISENBERG. Now, getting to the microscope itself, suppose a person without experience looked through the microscope directly at the hairs. Would he be able to directly interpret the hairs—a known and a questioned hair—to see if they are probably identical, or does it take experience even to interpret what you see through a microscope?

Mr. STOMBAUGH. This takes experience to interpret what you see.

We get quite a few people through the lab on tours and every now and then I will set up some hairs. I had one man making a match with a dog hair and a human hair, and he said they came from the same person, because he couldn't interpret what he saw. He just thought he saw something which he didn't.

Mr. EISENBERG. Mr. Stombaugh, could you tell from these hairs that you found in the blanket, and let me add parenthetically we sometimes have been calling this blanket a rug but we have been talking about the object——

Mr. DULLES. You call it a blanket, technically.

Mr. EISENBERG. Technically a blanket, and it is Exhibit 140. This Exhibit 140, Mr. Stombaugh, could you tell whether these hairs had been pulled out or had fallen out?

Mr. STOMBAUGH. These hairs had fallen out naturally. They have died and fallen from the body. This is a very normal occurrence. When one combs one's hair, ordinarily you will find one or two strands of hair on the comb, because hair is constantly being replaced in most people.

Mr. EISENBERG. How can you tell it had fallen out?

Mr. STOMBAUGH. From the shape of the root.

Mr. EISENBERG. What is the difference of the shape of the root where a hair falls out and the shape of the hair of a root where it has been taken out artificially or unnaturally?

Mr. STOMBAUGH. In Exhibit 667, I have a photomicrograph of a root of a human hair. Now, this hair has died and has fallen out naturally, you can tell by the shape of it here. The follicle has just come right along with it. It is starting to shrivel. If this hair was a healthy hair and had been forcibly removed, this root would have been collapsed and twisted. It is very characteristic, it is easy to tell whether a hair has been forcibly removed or whether it fell out naturally.

Mr. EISENBERG. Suppose it is cut, suppose the hair was cut, can you tell that?

Mr. STOMBAUGH. Yes, we can tell from looking at the tip of a hair whether it has been cut, burned, crushed, and whether it has been cut with a sharp instrument, such as a razor, or whether it has been cut with a dull instrument.

Mr. EISENBERG. Were these hairs cut, the hairs in 140, that you found in Exhibit 140?

Mr. STOMBAUGH. Some of the tips of the head hairs had been cut, but the limb hairs and the pubic hairs had not.

Mr. EISENBERG. But they all had roots on them?

Mr. STOMBAUGH. They all had roots on them.

Mr. EISENBERG. Getting back to the blanket for a moment, as to the composition, you testified that there were woolen, viscose, and cotton fibers. I don't recall whether you said that there were green and brown fibers of each type of textile?

Mr. STOMBAUGH. Yes, each type had green and brown fibers.

Mr. EISENBERG. Now, also getting back to the shape of the blanket when you received it, the shape of 140 and its folds, we had discussed a crease which you marked "C," which you said was caused by an object 10 inches long, and we discussed whether the object was 10 inches long or could have been longer.

How long was the crease "C"?

Mr. STOMBAUGH. The crease "C," the hump in the blanket itself, was approximately 10 inches long.

Mr. EISENBERG. And did that run—as the blanket is folded, and looking from "A" to the general area of "D"—and putting "A" at the left-hand side—can you tell us how that crease ran, did it run from left to right or from top to bottom?

Mr. STOMBAUGH. It ran from left to right.

Mr. EISENBERG. It ran from left to right, and about 10 inches long?

Mr. STOMBAUGH. Approximately 10 inches long.

Mr. EISENBERG. As I recall, you testified it was caused by a distortion in the fibers, that is to say, the fact the crease was still present even though there was no object in the blanket was caused by a distortion of the fibers?

Mr. STOMBAUGH. Yes, sir; the fibers had been stretched in this area—not the fibers, the yarns.

Mr. DULLES. Can one see that on the blanket itself?

Mr. EISENBERG. Let's take a look at 140, Mr. Stombaugh, and see if it is still present?

Mr. STOMBAUGH. If I can find where it was here. I doubt if it will still be present because the creases on the edges of the blanket are gone. I can't tell. It has been folded so much. No. I can't see it.

When I received the blanket in the laboratory, I noticed, when I put the blanket down flat, it had an area that was humped just like this.

Mr. EISENBERG. You have put a pencil underneath?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. And you have picked it up an inch or two, you have made a hump of about an inch or an inch and a half up from the rest of the blanket, is that correct?

Mr. STOMBAUGH. Yes. But it was very slight and you could hardly notice it, but I happened to look at the blanket from a distance and saw the hump and went over to measure it. But we tried to photograph it and we just couldn't get it. We tried various ways of lighting.

So I made a notation in my notes regarding that slight hump.

Mr. EISENBERG. Now, just to make the record clear, the hump was 10 inches long, and therefore you felt that the object immediately causing the hump must have been approximately 10 inches long, is that correct?

Mr. STOMBAUGH. Yes. The object causing the hump itself.

Mr. EISENBERG. But could it have been attached to an object which was longer than 10 inches, or could it have been attached to an object, running underneath the object causing the protrusion, which was longer than 10 inches?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. Okay. That is what I think was the source of the confusion earlier.

Now, you placed this mark "C" on this paper illustration, Exhibit 663. Does that—does the placement of the mark approximate the general area where you found the hump?

Mr. STOMBAUGH. Yes, approximately, according to my notes. It could be to the left a little or to the right a little. This isn't to scale.

Mr. EISENBERG. One last question on the blanket, Mr. Stombaugh. Could you form any opinion as to the quality of the blanket?

Mr. STOMBAUGH. Well, the composition of the blanket being mostly viscose, a very cheap synthetic, indicated to me that it was an inferior blanket, relatively inexpensive.

Mr. EISENBERG. Could you determine whether it was a domestic or a foreign product?

Mr. STOMBAUGH. No, I couldn't.

Mr. EISENBERG. It might have been either?

Mr. STOMBAUGH. Could have been either, yes.

Mr. EISENBERG. Now, Mr. Stombaugh, I hand you a photograph which is labeled on the bottom "C 11, Commission Exhibit 150." It is a color photograph of a brownish textured shirt, long-sleeved, with a hole in the right elbow, and I ask you whether you recognize the shirt that is pictured in that photograph?

Mr. STOMBAUGH. Yes, I do.

Mr. EISENBERG. Can you see your mark anywhere on that?

Mr. STOMBAUGH. Yes, my mark is in red, initials "PMS" are in the collar of the shirt.

Mr. EISENBERG. "PMS" being your initials, Paul M. Stombaugh?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. May I have this photograph admitted?

Mr. DULLES. It will be admitted, 673.

(The photograph referred to was marked Commission Exhibit No. 673, and was received in evidence.)

Mr. EISENBERG. Let me state for the record we are introducing the photograph at this point rather than the shirt itself because depositions are being taken in Dallas simultaneously with the testimony being elicited today, and the shirt is being used by those members of the staff who are in Dallas.

Mr. DULLES. I understand.

Mr. EISENBERG. When did you receive this shirt that is pictured in Exhibit 673, said shirt being Commission Exhibit 150?

Mr. STOMBAUGH. I received this shirt the same day I received the blanket, which was November 23, 1963, approximately 7:30 a.m.

Mr. EISENBERG. Now, did you conduct an examination to determine the composition of this shirt?

Mr. STOMBAUGH. Yes, I did.

Mr. EISENBERG. When did you do that?

Mr. STOMBAUGH. I did this later on that morning.

Mr. EISENBERG. What were your conclusions as to the composition, Mr. Stombaugh?

Mr. STOMBAUGH. The shirt is composed of gray-black cotton, dark blue cotton, and orange-yellow cotton fibers. The dark yarn in the shirt is composed of a mixture of dark blue and gray-black cotton fibers twisted together, and the light yellowish orange looking colors here, the yarns in this part of the shirt were composed of orange-yellow cotton fibers.

Mr. EISENBERG. Did you examine the shirt to determine—pardon me, Mr. Dulles, were you going to put a question on the composition?

Mr. DULLES. No.

Mr. EISENBERG. Did you examine the shirt to determine the presence of hairs or other debris?

Mr. STOMBAUGH. No, I didn't.

Mr. EISENBERG. You did not?

Mr. STOMBAUGH. No, sir.

Mr. EISENBERG. Neither then or at any subsequent time?

Mr. STOMBAUGH. No, sir.

Mr. EISENBERG. Could you take a look at your notes on that, Mr. Stombaugh, to make sure about that?

Mr. STOMBAUGH. No, sir; I did not remove the debris from the shirt. I noted in my notes the two buttons from the top were forcibly removed, the right elbow area was worn through, the bottom front inside of the shirt was ripped forcibly, and that I had made a known sample of this shirt.

Mr. EISENBERG. Mr. Stombaugh, I had been under the impression you found some wax on that shirt.

Mr. STOMBAUGH. Yes; down the face of the shirt I did find some wax adhering to it, and this wax I removed and delivered to the spectrographic unit for a spectrographic examination.

Mr. EISENBERG. Does that show in your notes?

Mr. STOMBAUGH. Yes; I was looking for debris and hairs. I knew I had not scraped the shirt.

Mr. EISENBERG. I am using the wrong term, I guess.

Mr. STOMBAUGH. I recall doing this. This was later in the afternoon when I removed this wax and took it to the spectrographic unit. This was after I had conducted other examinations on some other items.

Mr. EISENBERG. For the record, we had an earlier discussion, and you had mentioned this to me in an earlier discussion, as I recall——

Mr. STOMBAUGH. Yes; that is correct.

Mr. EISENBERG. Which prompted me to ask you the question. Did you find any body hairs on this shirt—or any hairs, I should say?

Mr. STOMBAUGH. I didn't look for hairs on this shirt. This type of examination had not been requested. It seemed unnecessary.

Mr. EISENBERG. Mr. Stombaugh, were you able to determine the quality of the shirt or did you form any opinion as to the quality of the shirt?

Mr. STOMBAUGH. Yes; it was an inexpensive shirt. I found no labels in it indicating the manufacturer.

Mr. DULLES. Any indication that labels had been torn out?

Mr. STOMBAUGH. Not that I recall, sir.

Mr. EISENBERG. Were you able to determine, Mr. Stombaugh, whether this was a domestic, whether this was of domestic or foreign origin?

Mr. STOMBAUGH. No; there are so many different shirt manufacturers in this country, that there is little value in trying to trace down a particular source unless we can find a manufacturer's marking in the shirt.

Mr. EISENBERG. Any laundry marks which you attempted to trace down?

Mr. STOMBAUGH. I found no laundry marks. The shirt was well worn and appeared to have been hand laundered.

Mr. EISENBERG. If there are no further questions on the shirt, I will move on to another item.

Mr. Stombaugh, I now hand you a homemade paper bag, Commission Exhibit 142, which parenthetically has also received another Exhibit No. 626, and ask you whether you are familiar with this item?

Mr. STOMBAUGH. Yes; I am.

Mr. EISENBERG. Does that have your mark on it?

Mr. STOMBAUGH. At the time I examined this, it was to be treated for latent fingerprints subsequent to my examination, and in a case like this I will not put a mark on the item itself because my mark might cover a latent fingerprint which is later brought up, and therefore obscure it.

In this particular instance, I made a drawing of this bag on my notes with the various sizes and description of it to refresh my memory at a later date.

Mr. EISENBERG. And it is—looking at those notes and as you remember now—this is the bag?

Mr. STOMBAUGH. This is the bag.

Mr. EISENBERG. Now, this bag has an area of very light-brown color, and the greater portion of the area is a quite dark-brownish color. What was the color when you originally received it?

Mr. STOMBAUGH. When I originally received this it was a light-brown color.

Mr. EISENBERG. Which is at one end of the bag?

Mr. STOMBAUGH. One end of the bag.

Mr. EISENBERG. The tape is also two colors, one a lightish brown and the other a darkish brown. What color was the tape when you received it?

Mr. STOMBAUGH. The tape also was light brown.

Mr. EISENBERG. Could you turn the bag over? Was it the color that shows as a lighter yellowish-type of brown?

Mr. STOMBAUGH. Yes; a yellow-brown shade.

Mr. EISENBERG. When did you receive it, by the way, Mr. Stombaugh?

Mr. STOMBAUGH. This was received on November 23, 7:30 a.m., 1963.

Mr. EISENBERG. Did you form any opinions as you examined it, concerning the construction of the bag?

Mr. STOMBAUGH. When I looked at the bag and examined it, it struck me as being a homemade bag such as I could make. Occasionally I will have a need for something like this at home. Therefore, I will take some brown paper and a strip of tape home with me. Then when I get home I will fold the tape—fold the paper rather—in the shape I need—and to seal it up I will tear strips of the sealing tape from the little piece I have.

Here we find that this tape has been torn at several places, such as one would do in an instance like that. Due to these torn edges, I was under the impression, from looking at the bag, that it was a homemade bag which someone had made at home and they did not have a tape dispenser which machine-cuts tape. Therefore, they had to tear it, which they did—or cut it, of course—with a knife. And this is the case where pieces of tape were torn.

Mr. EISENBERG. You were pointing to various torn edges as you testified, is that correct?

Mr. STOMBAUGH. Yes; that is correct.

Mr. EISENBERG. How many, if any, square-cut edges did you notice?

Mr. STOMBAUGH. I found—according to my drawing—two machine-cut edges.

Mr. EISENBERG. Would that indicate—well, do you form any opinion as to, on the basis of that, as to the origin, possible origin, of the tape?

Mr. STOMBAUGH. The origin of the tape as far as the manufacturer——

Mr. EISENBERG. What I am referring to is this: on the basis of that would you draw an inference that the person had taken—whoever made this bag—had taken two lengths of tape from a dispensing machine and had subsequently torn it up into smaller strips, or do you think he had one length of tape from a dispensing machine which he subsequently tore up into smaller strips?

Mr. STOMBAUGH. From the ends that I could see, now I don't know whether there were any ends underneath which I did not have a chance to look at, I don't have anything in my notes, but from what I can see it would appear he took a strip of tape, machine-cut from a dispenser, and used that entire strip, thus using up both ends of the tape because we have two machine-cut ends.

Mr. EISENBERG. In other words, it would be a machine-cut strip at the beginning of the tape which the person pulled out, left over from the last cut?

Mr. STOMBAUGH. That is right.

Mr. EISENBERG. And a machine-cut at the end, where the person himself ripped the tape from the machine?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And you infer that he then divided it into smaller strips on the occasion when he made the bag?

Mr. STOMBAUGH. Yes, sir; he pulled one strip, of course, he could have pulled two or three strips, I don't know, but it would appear he took one strip of tape and tore it into smaller pieces to be used on the bag.

Mr. EISENBERG. Did you notice any bulges or creases or folds apart from the fold used in making of the bag?

Mr. STOMBAUGH. No; I didn't. I noticed that one end of the bag had been torn.

Mr. EISENBERG. Now, would you say that the absence of bulges would be inconsistent with the carrying of a heavy object or an irregularly shaped object in the bag?

Mr. STOMBAUGH. Well, I don't believe I am qualified to answer that question, because I actually am not an expert in paper.

Mr. EISENBERG. All right. We will leave that to the questioned document examiner and we will take it up with him.

Did you notice anything else about the bag relating to its gross physical characteristics and its shape, apart from any debris which you may have found inside or outside the bag?

Mr. STOMBAUGH. No, sir; just an oblong homemade bag was the impression I received from looking at it.

Mr. EISENBERG. Do you think it was, if it was in fact a homemade bag, do you think it was a well-made bag, Mr. Stombaugh? Did you form any opinion as to that?

Mr. STOMBAUGH. In my opinion, just a personal opinion, the person was aware as to how to make a bag, to seal the ends by folding both corners in and then folding them flat.

Mr. EISENBERG. You just demonstrated that both corners originally were folded by the crease lines, and you folded it over again to show how it was made?

Mr. STOMBAUGH. Yes; this makes a neat and also a secure corner or end to the bag, to prevent losing any of the contents.

Mr. EISENBERG. Mr. Stombaugh, did you examine the outside of this paper bag——

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. Exhibit 142 and also 626, to see if there were any foreign items on the surface?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. And what did you find?

Mr. STOMBAUGH. I found that the bag had previously been dusted for latent fingerprints because I found traces of what appeared to be fingerprint powder on it.

I was using white gloves at the time I examined this and the gloves became quite soiled from the fingerprint powder.

Mr. EISENBERG. Did you find anything else?

Mr. STOMBAUGH. No; nothing on the outside of the bag.

Mr. EISENBERG. How did you conduct that examination, by the way?

Mr. STOMBAUGH. With a low-power microscope.

Mr. EISENBERG. Did you find any cotton fibers on the outside of the bag at all, Mr. Stombaugh, white or colored?

Mr. STOMBAUGH. There were white cotton fibers on the outside but I was using a pair of white cotton gloves, so these would be of no value. White cotton is the most common thing we have in the way of textiles, and therefore it just doesn't have sufficient individual characteristics to be of value for comparison and identification purposes. It is for this reason that we use gloves of this material.

Mr. EISENBERG. And those fibers may have come from your white cotton gloves?

Mr. STOMBAUGH. Yes; they could very easily have come from my gloves from handling the object with a pair of gloves on.

Mr. EISENBERG. Did you proceed to examine the inside of the paper bag to see if there were any foreign objects?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. What were your conclusions?

Mr. STOMBAUGH. I removed the debris from the inside of the bag by opening the bag as best I could, and tapping it and knocking the debris on to a small piece of white paper, and I found a very small number of fibers. Upon examining these fibers, I found a single brown, delustered, viscose fiber and several light-green cotton fibers from the inside of the bag. I also found a minute particle of wood and a single particle of a waxy substance.

Mr. EISENBERG. Did you attach any significance to the particle of wood, Mr. Stombaugh?

Mr. STOMBAUGH. No; it was too minute for identification purposes. It could have come from any surface, including the bag itself. Sometimes all of the wood used in the manufacture of paper doesn't go into a pulp, and this might be a very tiny such fragment.

Mr. EISENBERG. Did you examine the wood fragment?

Mr. STOMBAUGH. I looked at it microscopically.

Mr. EISENBERG. Did you attempt to compare it with the wood of the Exhibit 139, which is a rifle?

Mr. STOMBAUGH. Yes; the wood particle from the bag was too minute for comparison purposes. There wasn't much you could do with it, it was very small.

Mr. EISENBERG. Did you attach any significance to the body wax—or to the wax, I should say?

Mr. STOMBAUGH. The wax particle I noticed, and I recalled having seen wax on the shirt, Exhibit No. 673, so therefore I put that aside for a spectrographic examination and comparison of the wax particle from the inside of the bag with the wax from the shirt.

Mr. EISENBERG. And what were the results?

Mr. STOMBAUGH. They were entirely different.

Mr. EISENBERG. Was there any analysis made of the wax in the bag as to its origin, do you know?

Mr. STOMBAUGH. It was examined by the spectrographic examiner and he found it was just common wax.

Mr. EISENBERG. When you say common wax, do you mean the kind you wax a floor with?

Mr. STOMBAUGH. No; more like that which could have come from a candle, candle wax.

Mr. EISENBERG. What about the wax on the shirt as to origin?

Mr. STOMBAUGH. It was paraffin.

Mr. EISENBERG. Now you also said there were several fibers, Mr. Stombaugh?

Mr. STOMBAUGH. Yes, sir; I did. There was a single brown delustered viscose fiber and several light-green cotton fibers.

Mr. EISENBERG. Did this single brown viscose fiber match the fibers from the blanket, Exhibit 140?

Mr. STOMBAUGH. Yes; it did.

Mr. EISENBERG. In what characteristics were they matched?

Mr. STOMBAUGH. The fibers in the blanket had a large number of brown viscose fibers, delustered and one fiber I found in the bag was also a viscose fiber of the same type and color as seen under a low-powered microscope. The delustering spots seen on the fiber were the same size, and both fibers were approximately the same diameter.

Mr. EISENBERG. How common is viscose, Mr. Stombaugh, as a fiber?

Mr. STOMBAUGH. Viscose is fairly common. It is used in many types of garments; it depends on the quality of the garment.

Mr. EISENBERG. And this was delustered viscose, did you say?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. How common is delustered viscose?

Mr. STOMBAUGH. It is most common, I would say. It is more common than lustrous.

Mr. EISENBERG. Generally speaking, how many variations of diameter would a delustered viscose come in?

Mr. STOMBAUGH. This is entirely up to the manufacturer. He can make viscose any diameter he wants, and there could be hundreds of variations in the diameter of viscose fibers.

Mr. EISENBERG. But the fiber you found in the paper bag, 142, matched the fibers you found in the Exhibit 140?

Mr. STOMBAUGH. Yes, sir; but the viscose fibers in the blanket varied in size also.

Mr. EISENBERG. To what extent?

Mr. STOMBAUGH. There were 10 to 15 different diameters of viscose in this blanket. It appeared to me as if the blanket was made of scrap viscose, scrap fibers.

Mr. EISENBERG. So that the diameters would be random?

Mr. STOMBAUGH. They were random; yes, sir.

Mr. EISENBERG. Now, what about the color, was the color a match between the fiber found in 140—in 142—and the fiber which is in the composition of 140, the blanket?

Mr. STOMBAUGH. Yes; the color matched some of the viscose fibers, the brown viscose fibers in the blanket. Of course, these colors also varied slightly but not to any great extent, not like the diameter.

Mr. EISENBERG. Were there any other common characteristics between the viscose fibers found in the blanket and the viscose fibers found in the paper bag?

Mr. STOMBAUGH. The viscose fiber I found in the bag matched in all observable microscopic characteristics some of the viscose fibers found in the composition of this blanket. This would be the diameter, the diameter of that same fiber would have the same size of delustering markings, same shape, same form, and also same color.

Mr. EISENBERG. Now, what about the green cotton fiber that you found in the paper bag, Mr. Stombaugh, how did that compare with the green cotton fiber—was it a green cotton fiber that your testimony mentioned?

Mr. STOMBAUGH. Yes; there were several light green cotton fibers.

Mr. EISENBERG. How did they compare with the green cotton fibers which are contained in the composition of the blanket?

Mr. STOMBAUGH. These matched in all observable microscopic characteristics.

Mr. EISENBERG. And those were what?

Mr. STOMBAUGH. The color and the amount of twist of the cotton fibers were the same as the color and twist found in these. Mainly the color is what we go by on cotton.

Mr. EISENBERG. Were they mercerized or unmercerized?

Mr. STOMBAUGH. They were not mercerized.

Mr. EISENBERG. How common is cotton as a fiber, Mr. Stombaugh?

Mr. STOMBAUGH. Cotton is the most common fiber used.

Mr. EISENBERG. And what about nonmercerized cotton, as to commonness?

Mr. STOMBAUGH. You would find more unmercerized cotton in use than mer-

cerized, because to mercerize cotton is an added production factor used in cotton.

Mr. EISENBERG. How great a variation do you get in degree of twist?

Mr. STOMBAUGH. You are referring to between mercerized and un——

Mr. EISENBERG. No; within unmercerized cotton.

Mr. STOMBAUGH. This would depend on the quality of the cotton and the length of the cotton also.

Mr. EISENBERG. But I mean as samples come across your desk in your office, or as you read about them in books, is there a great variation in twist or a small variation?

Mr. STOMBAUGH. It depends—there is a small variation but this would depend on the type of cotton. There are different types of cotton, and each is determined from the length of the individual cotton fiber.

Mr. EISENBERG. Could you tell what kind of cotton you were dealing with in the blanket?

Mr. STOMBAUGH. No; because here we are not dealing with a full-length cotton fiber. We are dealing with a fragment of a single fiber.

Mr. EISENBERG. Now, could you determine whether there was a variation in the twist of the cotton fibers within the blanket itself as there was, you say, in the diameter of the viscose fibers?

Mr. STOMBAUGH. The twist seemed to coincide with the twist found in the cotton from the blanket.

Mr. EISENBERG. Yes. But looking just to the blanket now for a second, you said the brown viscose or the viscose generally in the blanket itself varied as to diameter. Did the cotton in the blanket vary within itself as to twist or was the cotton of a fairly uniform twist?

Mr. STOMBAUGH. No; it was fairly uniform twist.

Mr. EISENBERG. And you said the fibers you found, the green cotton fibers you found, in the bag were the same twist as the twist of the cottons which composed the blanket?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And just to tie this into the questions I was asking a few seconds ago, would this degree of twist be significant, that is can you determine under the microscope 4 different kinds of degrees of twist or 20—how many different degrees of twist can you determine under a microscope, just approximately?

Mr. STOMBAUGH. Are you referring to the same type of cotton——

Mr. EISENBERG. Well, when you get a piece of cotton?

Mr. STOMBAUGH. Or cotton as a whole?

Mr. EISENBERG. When you get a piece of cotton under the microscope and you don't know what type it is? I am referring to cotton as a whole.

Mr. STOMBAUGH. I see. The degree of twist could be—now if we are dealing with fresh cotton, cotton running right from the plant, then the degree of twist, this varies, and this could be used in the identification of the type of cotton. But in the manufacturing process quite frequently when the cotton is spun into yarns then this twist is affected.

Mr. EISENBERG. Well, at this point I am not interested in determining the type of cotton. What I am interested in is determining how significant the degree of twist is as an identifying factor.

Mr. STOMBAUGH. I would say no significance at all as far as the sole identifying characteristic goes, whether or not this cotton of this cotton has the same twist. The twist we use is for identification purposes only, supplementing other identifying characteristics.

Mr. EISENBERG. That is the only purpose I am interested in.

Mr. STOMBAUGH. Yes; that is the only purpose.

Mr. EISENBERG. But in getting to that, how valuable is it for identification purposes? I am curious as to how many—how much a twist can vary. As you pick up a random fiber, and put it under your microscope, I am interested in how much the twist can vary. For example, if there are only two possibilities, then it isn't too helpful that you get a match in twist, but if there are great variations in twist in cotton fibers as they come under your microscope, it would be helpful in making your identification.

Mr. STOMBAUGH. I see what you are getting at. There are great variations.

Sometimes in a cotton fiber, the twist will be rather far apart. Other times it will be rather close together. This piece——

Mr. EISENBERG. So that the fibers, the cotton fibers, to begin with, matched in twist, that is, the cotton fibers you found in the paper bag matched the twist of the ones that are contained in the blanket, and you said they also matched in color?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. I would like to ask you the same question as to color that I asked you as to twist. How many different shades do you think you can distinguish under the microscope in a green cotton? Would the range be just 2 or 3 different shades, or do you think you could distinguish between 20 or 30 different types of green cotton if you laid them next to each other under the microscope?

Mr. STOMBAUGH. No; the range in green cotton fibers, for that matter in any color, is tremendous. This could go to 50 sometimes 100 different shades which you can distinguish under a microscope. To the naked eye, it would look as if it is just green. But you could take, say five different fabrics of the same type that have been dyed exactly the same color or rather you think they are the same shade, and put the individual fibers under the microscope and there will be a big difference noted in shades.

Mr. EISENBERG. Now were the green cotton fibers in the blanket uniform as to shade between themselves?

Mr. STOMBAUGH. No; these varied.

Mr. EISENBERG. To what extent?

Mr. STOMBAUGH. They go from a green to a very pale green.

Mr. EISENBERG. So that the——

Mr. STOMBAUGH. Might be seven or eight different shades.

Mr. EISENBERG. So when you say there is a match, you mean the green cotton fibers you found in the paper bag were within the spectrum of shades that are laid out in the green cotton fibers from the blanket—is that correct?

Mr. STOMBAUGH. No. I forget how many different shades of green I found in this blanket. Under the circumstances, I considered the exact number of no particular significance. But we will say it might be possibly eight different separate shades, and the fibers I found from the blanket matched some of these shades. Not all of them; but there might be a medium-green fiber that I found in the bag, which I matched with a medium-green fiber from this blanket. It might have been one that had a yellowish-green tinge to it, which I also matched with the yellowish-green tinged cotton fibers from the blanket.

So unless the colors match absolutely, there is no match.

Mr. EISENBERG. Do you recall how many green cotton fibers you found in the paper bag?

Mr. STOMBAUGH. I have here in my notes "several"—

Mr. EISENBERG. Yes?

Mr. STOMBAUGH. I have here in my notes "several light green cotton fibers," which would be approximately two or three.

Mr. EISENBERG. Do you recall whether they represented two or three different shades?

Mr. STOMBAUGH. Yes; they were all different from each other but each matched the cotton fibers in the blanket.

Mr. EISENBERG. So you had two or three cotton fibers of two or three shades of green in the bag, and they matched against these two or three of the seven or eight shades of green cotton which were in the blanket, is that a correct recapitulation?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. And you say there are 50 to 100—approximately—green shades of cotton that can be distinguished under the microscope?

Mr. STOMBAUGH. Yes; I would say that is true. This would vary from dark green, of course, all the way up to light-pale green.

Mr. EISENBERG. Did you find anything else within the bag, Mr. Stombaugh?

Mr. STOMBAUGH. No, sir; that is all I found inside the bag.

Mr. EISENBERG. Now, what do you think the degree of probability is, if you

can form an opinion, that the fibers from the bag, fibers in the bag, ultimately came from the blanket?

Mr. STOMBAUGH. When you get into mathematical probabilities, it is something I stay away from, since in general there are too many unknown factors. All I would say here is that it is possible that these fibers could have come from this blanket, because this blanket is composed of brown and green woolen fibers, brown and green delustered viscose fibers, and brown and green cotton fibers.

Now these 3 different types of fibers have 6 different general colors, and if we would multiply that, say by a minimum of 5 different shades of each so you would have 30 different shades you are looking for, and 3 different types of fibers. Here we have only found 1 brown viscose fiber, and 2 or 3 light green cotton fibers. We found no brown cotton fibers, no green viscose fibers, and no woolen fibers.

So if I had found all of these then I would have been able to say these fibers probably had come from this blanket. But since I found so few, then I would say the possibility exists, these fibers could have come from this blanket.

Mr. EISENBERG. Now, let me ask you a hypothetical question, Mr. Stombaugh. First, I hand you Commission Exhibit 139, which consists of a rifle found on the sixth floor of the Texas School Book Depository Building, and I ask you, if the rifle had lain in the blanket, which is 140, and were then put inside the bag, 142, could it have picked up fibers from the blanket and transferred them to the bag?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. Are there any further questions as to the blanket?

Mr. DULLES. Do you have any, Mr. Murray?

Mr. MURRAY. I have none, Mr. Dulles.

Mr. EISENBERG. Do you recognize Exhibit 139? Are you familiar with that?

Mr. STOMBAUGH. Yes; I am.

Mr. EISENBERG. Did you examine that in the laboratory?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. Do you know when you made that examination?

Mr. STOMBAUGH. On the morning of November 23, 1963.

Mr. EISENBERG. Is your mark on it?

Mr. STOMBAUGH. Yes, sir; here is my mark.

Mr. EISENBERG. Which consists of your initials?

Mr. STOMBAUGH. My initials, and the date 11–23–63. Do you mind if I check to see if this is unloaded?

Mr. EISENBERG. Did you examine the rifle to determine whether it contained on its surface or crevices any hair or other debris?

Mr. STOMBAUGH. Yes; I did.

Mr. EISENBERG. Can you tell us how you made that examination?

Mr. STOMBAUGH. Yes, sir. The gun was to be treated for latent fingerprints also, so I wore a pair of white cotton gloves to protect any latents that might be present on the gun. I placed the gun under a low-powered microscope and examined the gun from the end of the barrel to the end of the stock, removing what fibers I could find from crevices adhering to the gun.

I noticed immediately upon receiving the gun that this gun had been dusted for latent fingerprints prior to my receiving it. Latent fingerprint powder was all over the gun; it was pretty well dusted off, and at the time I noted to myself that I doubted very much if there would be any fibers adhering to the outside of this gun—I possibly might find some in a crevice some place—because when the latent fingerprint man dusted this gun, apparently in Dallas, they use a little brush to dust with they would have dusted any fibers off the gun at the same time; so this I noted before I ever started to really examine the gun.

Mr. EISENBERG. Were you unhappy at all about that?

Mr. STOMBAUGH. I was; however, it is not uncommon for fingerprint processing to be given priority consideration. They wanted to know whether or not the gun contained any fibers to show that it had been stored in this blanket, and with all the obstructions and the crevices on the metal parts of this gun, ordinarily a fiber would adhere pretty well, unless you take a brush and brush it off, and then you brush it on the floor and it is lost.

Mr. EISENBERG. Who was "they," you said "they" wanted to know?

Mr. STOMBAUGH. Well, this is our Dallas office. They sent the gun in wanting to know this fact.

Mr. EISENBERG. Proceed.

Mr. DULLES. It was dusted by the Dallas police, was it, first?

Mr. STOMBAUGH. I don't know who dusted it.

Mr. EISENBERG. For the record, I believe that will be shown later that it was dusted by Dallas police.

As far as you know, did it come into your office, into your laboratory before it went to the identification division, latent fingerprint section?

Mr. STOMBAUGH. Yes; I received this gun from Special Agent Vincent Drain of the Dallas FBI office. It was crated very well. I opened the crate myself and put my initials on the gun and at that time I noted it had been dusted for latent prints.

So I proceeded to pick off what fibers were left from the small crevices and small grease deposits which were left on the gun.

At this point of the butt plate, the end of the stock——

Mr. EISENBERG. Let's get that a little more specific if we can. Can you point to that again?

Mr. STOMBAUGH. In this area, the butt plate of the stock, this is a metal butt plate, you can see the jagged edge on it.

Mr. EISENBERG. That is on the left side of the butt plate?

Mr. STOMBAUGH. It is on the left side; yes.

Mr. EISENBERG. In approximately in the middle there is a jagged edge, jagged inside edge, where the butt plate comes into contact with the wood, is that what you are referring to?

Mr. STOMBAUGH. Yes; there is a jagged edge there. This area right here, according to my notes.

Mr. EISENBERG. Yes.

Mr. STOMBAUGH. I found a tiny tuft of fibers which had caught on that jagged edge, and then when the individual who dusted this dusted them, he just folded them down very neatly into the little crevice there, and they stayed. These I removed and put on a glass microscope slide, and marked this particular slide "No. 2," because this little group of fibers—little tuft of fibers, appeared to be fresh.

The fibers on the rest of the gun were either adhering to a greasy, oily deposit or jammed into a crevice and were very dirty and apparently very old.

You can look at a fiber and tell whether it has been beaten around or exposed much. These appeared to be fairly fresh.

Mr. EISENBERG. "These" being the ones that you found in the butt plate crevice?

Mr. STOMBAUGH. Yes; adhering to this small jagged edge.

Mr. EISENBERG. Before we get to those, were there any other fibers of value on the rest of the Exhibit 139?

Mr. STOMBAUGH. No; the other fibers I cleaned up, removed the grease and examined them but they were of no value. They were pretty well fragmented.

Mr. EISENBERG. You could not make a determination as to their nature?

Mr. STOMBAUGH. I could tell what type they were.

Mr. EISENBERG. Meaning textile type?

Mr. STOMBAUGH. Yes; such as wool, cotton, what-have-you, but the grease and the dirt had changed the colors which ruined the characteristics for comparison purposes.

Mr. EISENBERG. Could you tell whether they were old or new?

Mr. STOMBAUGH. They all appeared old.

Mr. EISENBERG. What about——

Mr. DULLES. What do you mean by old, 2 or 3 months old, 2 or 3 weeks old?

Mr. STOMBAUGH. Well, a length of time, I would say that in excess of a month or 2 months.

Mr. DULLES. In that area?

Mr. STOMBAUGH. In that area or longer. They weren't recently put in there. Let's say that.

Mr. EISENBERG. What about the grease, did you attempt to examine the grease?

Mr. STOMBAUGH. No.

Mr. EISENBERG. Why was that?

Mr. STOMBAUGH. I could see no need of it at that time.

Mr. EISENBERG. Let's return then to the fibers which you referred to as being fresh, which you said you found in the crevice of the butt plate, and I will ask Mr. Dulles' question in reverse: What do you mean by fresh, why do you call these fresh?

Mr. STOMBAUGH. In the first place, this was just a small tuft. They were adhering to the gun on a small jagged edge. In other words, the gun had caught on a piece of fabric and pulled these fibers loose. They were clean, they had good color to them, there was no grease on them and they were not fragmented. They looked as if they had just been picked up. They were folded very neatly down in the crevice.

Mr. EISENBERG. Were these fibers in a position where they could have easily been knocked off by rough use?

Mr. STOMBAUGH. No; they were adhering to the edge rather tightly.

Mr. EISENBERG. In the crevice?

Mr. STOMBAUGH. Well, it had the jagged edge sticking up and the fibers were folded around it and resting in the crevice.

Mr. DULLES. I think you testified, though, that might have been done in part by the dusting?

Mr. STOMBAUGH. Yes, sir; I believe when the fingerprintman dusted it he probably ran his brush along the metal portion here.

Mr. EISENBERG. Of the butt plate?

Mr. STOMBAUGH. Of the butt plate, and at the time the brush folded these down into the crevice.

Mr. EISENBERG. What led you to the particular conclusion that they had been folded into the crevice by the dusting?

Mr. STOMBAUGH. Because of the presence of fingerprint powder being down in and through the crevice here. It looked as if it had been dusted with a brush. You could make out the bristlemarks of the brush itself.

Mr. EISENBERG. Now assuming your conclusion is accurate that they were dusted into the crevice, and had not been in the crevice originally but had merely adhered to the jagged edge, how much—how rough a handling would it have taken to have gotten them loose from that jagged edge?

Mr. STOMBAUGH. Well, I would imagine if one took a brush and started brushing pretty hard these would have worked loose and come out.

Mr. EISENBERG. Would the use of the weapon itself have jarred them loose?

Mr. STOMBAUGH. I doubt it. I doubt it.

Mr. EISENBERG. I am talking now about the jagged edge position, and not the crevice position.

Mr. STOMBAUGH. You mean breaking them loose? They were adhering to the jagged edge.

Mr. EISENBERG. Yes.

Mr. STOMBAUGH. It might, of course—there are a lot of factors here you don't know, but they were adhering pretty tightly to the gun. I believe through ordinary handling of the gun eventually they would have worked loose and fallen off.

Mr. EISENBERG. What I can't understand is, when you are talking about the handling of the gun are you talking about the position in which you found them, or are you talking about the position which you deduced they were in before you found them brushed into the crevice?

Mr. STOMBAUGH. Well, both. The position I found them in. I had to take a pair of tweezers and work them out.

Mr. EISENBERG. Yes?

Mr. STOMBAUGH. And after I had the fibers lifted up which could have been the original position they were in, then I had to pull them off. They were wrapped around rather snugly to the sharp edge.

Mr. EISENBERG. Now, returning once more to this question of freshness. Would you say they had been placed there within 1 hour, or 1 day, or 1 week of the time when you received the rifle or longer?

Mr. STOMBAUGH. I couldn't say in that regard to any period of time. I refer, by

saying they appeared fresh, to the fact that the other fibers I removed from this gun were greasy, mashed, and broken, where these were fairly good long fibers. They were not dirty, with the exception of a little bit of fingerprint powder on them which I cleaned off, and the color was good. They were in good shape, not fragmented. They could conceivably have been put on 10 years ago and then the gun put aside and remain the same. Dust would have settled on them, would have changed their color a little bit, but as far as when they got on the gun, I wouldn't be able to say. This would just be speculation on my part.

Mr. EISENBERG. In other words, you concluded they were fresh—well, you said you thought they were fresh, Mr. Stombaugh, and I don't quite understand now whether you seem to be backing off a little from that?

Mr. STOMBAUGH. No; I am not trying to do that. I am trying to avoid a specific time element, since there are other factors which may enter. I couldn't—this is something that I won't even attempt to do, just say this was on here for 1 hour or 10 minutes, something like that.

But I would say these fibers were put on there in the recent past for this reason. If they had been put on there say 3, 4, 5 weeks or so ago, and the gun used every day, these fibers would have come off.

Am I making myself a little more clear?

Mr. EISENBERG. Yes; you are making yourself clear; yes.

Now, looking at Exhibit 139, the weapon, and Exhibit 140, the blanket, do you think it is possible that the bulge you described before, which you marked "C," might have been caused by some component part of 139, the rifle?

Mr. STOMBAUGH. Yes. At the time I found the hump in the blanket which I believed you have marked point C.

Mr. EISENBERG. That is point C on the replica piece of paper you have folded up, marked Exhibit 663?

Mr. STOMBAUGH. I checked the telescopic sight on Exhibit 139, and noted that the approximate length and general shape of the scope——

Mr. DULLES. Exhibit 139 being the blanket?

Mr. EISENBERG. Being the rifle.

Mr. STOMBAUGH. Were approximately the same so far as length and shape went, and at the time I thought to myself it is quite possible the hump in the blanket could have been made by that telescopic sight.

Mr. EISENBERG. Did you attempt to match up the rifle into the blanket to see if that could be true?

Mr. STOMBAUGH. No; I didn't want to handle the rifle any more than possible. I took a ruler and measured the scope and then compared the measurement with the hump in the blanket and it was approximately the same.

Mr. EISENBERG. What about the relationship, the spatial relationship of the scope to the end of the gun, as compared with the spatial relationship of the hump in the blanket to the end of the blanket? Were those matching?

Mr. STOMBAUGH. From the way the blanket was folded at the time, and from measuring this, and not using the gun itself and putting it in contact with the blanket, just from measurements, I determined it is possible that the scope could have made the hump. In other words, the gun could have fitted in there. But I couldn't be absolutely certain on any of this. This is just from measurements.

Mr. EISENBERG. And visual comparison?

Mr. STOMBAUGH. And visual comparison; yes.

Mr. EISENBERG. Is there any further information you would like to give us concerning your examinations of the paper bag, the rifle, the blanket, or the shirt which we have discussed this morning?

Mr. STOMBAUGH. Just the fibers I removed.

Mr. DULLES. Are you going to go into the relationship of the fibers that were found in the jagged edge?

Mr. EISENBERG. Yes. Mr. Stombaugh, did you attempt to determine the origin of the fibers which were caught in the butt plate of the rifle?

Mr. STOMBAUGH. Yes, sir; I did. I tried to match these fibers with the fibers in the blanket, and found that they had not originated from the blanket, because the cotton fibers were of entirely different colors. So I happened to think of the shirt and I made a known sample of the shirt fibers.

Mr. EISENBERG. What does that mean?

Mr. STOMBAUGH. I removed fibers from the shirt to determine the composition of it and also the colors. I found that the shirt was composed of dark-blue, grayish-black, and orangish-yellow cotton fibers, and that these were the same shades of fibers I had found on the butt plate of the gun.

Mr. DULLES. Did you find all three shades?

Mr. STOMBAUGH. All three shades; yes, sir.

Mr. EISENBERG. All three shades were found on the fragments that were found in the butt of the gun?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. Have you made photographs showing these, color photographs showing these?

Mr. STOMBAUGH. Yes, sir. Color photographs are very difficult to make microscopically because the color isn't always identical to what you see in the microscope. So these colors are slightly off.

Mr. EISENBERG. You have shown a chart captioned "Microphotograph Showing Match Between Orange-Yellow Cotton Fibers From Butt Plate of Assassination Rifle and Orange-Yellow Cotton Fibers From Oswald's Shirt." Did you take this photograph?

Mr. STOMBAUGH. No; it was taken under my supervision.

Mr. EISENBERG. It was taken under your supervision.

Mr. Chairman, may I submit this as 674.

Mr. DULLES. It will be admitted, 674.

(The item referred to was marked Commission Exhibit No. 674, and was received in evidence.)

Mr. EISENBERG. What is the magnification?

Mr. STOMBAUGH. I believe this was 400 also. I am not certain of this, because the shot itself has also been enlarged.

Mr. EISENBERG. Now you were discussing the reproduction of the color in the photomicrograph?

Mr. STOMBAUGH. Yes, sir. These are the orangish-yellow fibers. The color is not exactly the same as what one would see under the microscope.

However, you can see that the fibers on both sides, namely, the fiber from the rifle here, and this——

Mr. DULLES. On the right-hand side——

Mr. STOMBAUGH. On the right-hand side.

Mr. DULLES. Of Exhibit 674?

Mr. STOMBAUGH. And the fibers from the shirt, which are on the left-hand side of Exhibit 674, do match. The colors are the same and also, we find the same twist in the fiber.

Mr. EISENBERG. Now, was the orange-yellow cotton fiber—were the orange-yellow cotton fibers in the shirt of a uniform shade?

Mr. STOMBAUGH. Yes; they were all of a uniform shade. It was what we would call a uniform dye job.

Mr. EISENBERG. What about the twist?

Mr. STOMBAUGH. The twist was about normal. These, you can see here.

Mr. EISENBERG. You are pointing to the right-hand side and left-hand side of 674?

Mr. STOMBAUGH. You can see the twist to these fibers.

Mr. EISENBERG. Did they have a uniform twist?

Mr. STOMBAUGH. Uniform.

Mr. EISENBERG. So that the match was identical as to twist and shade, and the fibers in the shirt were uniform in themselves as to these two characteristics, is that correct?

Mr. STOMBAUGH. Yes; that is correct.

Mr. EISENBERG. Did you take a photograph of the gray-black cotton fibers?

Mr. STOMBAUGH. These are the gray-black cotton fibers and the color didn't come out well on these in this instance because of time and color process limitations.

Mr. EISENBERG. Just a second. You have a chart here—a photomicrograph—captioned "Microphotograph Showing Match Between Gray-Black Cotton Fibers

From Butt Plate of Assassination Rifle, etc. and Gray-Black Cotton Fibers From Oswald's Shirt."

Did you take these photographs or were they taken under your supervision?

Mr. STOMBAUGH. Under my supervision.

Mr. EISENBERG. May I have this admitted as 675?

Mr. DULLES. 675, it will be admitted.

(The item referred to was marked Commission Exhibit No. 675, and received in evidence.)

Mr. STOMBAUGH. The same would apply to Exhibit 675 as to 674, with the exception of the color. The color on these is much darker and we tried up to last night to duplicate the exact color and this is the best I could come up with under the time and color process limitations. It took us about 4 hours to make a photograph such as this.

Mr. EISENBERG. There is an apparent match of colors in the photograph——

Mr. STOMBAUGH. But there is one——

Mr. EISENBERG. I say, there is an apparent match in photographs, in color, or is that just my eyes deceiving me?

Mr. STOMBAUGH. This one appears to be slightly lighter than this shade.

Mr. EISENBERG. I see.

Mr. STOMBAUGH. But actually they are both a gray black, almost black in color.

Mr. EISENBERG. But under the microscope they were identical, and a different shade than what we see in Exhibit 675?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. In all these cases did you make your determination of color and match under the microscope, or by use of the photographs?

Mr. STOMBAUGH. Under the microscope.

Mr. EISENBERG. And these are illustrative and prepared for the Commission's use?

Mr. STOMBAUGH. Yes, sir.

Mr. EISENBERG. Now, you have a chart of photomicrograph captioned "Match Between Dark Blue Cotton Fibers From Butt Plate of Assassination Rifle, etc." Did you prepare these photographs or were they prepared under your supervision?

Mr. STOMBAUGH. Under my supervision.

Mr. EISENBERG. May I have these received as Exhibit 676?

Mr. DULLES. 676.

(The item referred to was marked Commission Exhibit No. 676, and was received in evidence.)

Mr. EISENBERG. What is the magnification of 675 and 676, by the way?

Mr. STOMBAUGH. All of these were made at approximately 400 diameters.

Mr. EISENBERG. Did you find a color match here?

Mr. STOMBAUGH. Yes; the color match of the dark blue cotton fibers shows rather well in this photograph, Exhibit 676.

Mr. EISENBERG. Now there is also a violet-colored fiber running through the right-hand side of 676.

Mr. STOMBAUGH. Yes, sir; I asked the photographer about this when he developed this and I said, "Why did we get this, this is not in the slide at all," and he said that is one of the orange fibers. They use different techniques in bringing out the blue and the yellow-orange in a photomicrograph.

Mr. DULLES. The shades are the fiber of the blanket?

Mr. STOMBAUGH. No; this shade in the photograph is different from what that fiber actually is. It is in the development process. I am not too familiar with color photography. There is an art to it. However, I do know that there are times and technical limitations on the accuracy of color reproductions.

Mr. EISENBERG. Mr. Stombaugh, were the shades in—were the shades of the dark blue cotton fibers uniform throughout the shirt which is pictured in Commission Exhibit 673?

Mr. STOMBAUGH. No sir; the dark blue fibers had some lighter shades and some slightly darker shades.

Mr. EISENBERG. About how many different shades?

Mr. STOMBAUGH. There were only about three in this.

Mr. EISENBERG. Do you recall how many dark blue fibers you got from the butt plate?

Mr. STOMBAUGH. I believe a total of six or seven fibers from the butt plate and three of them are blue fibers and all matched.

Mr. EISENBERG. Do you recall whether they were one or more shades?

Mr. STOMBAUGH. Two shades.

Mr. EISENBERG. So that two of the fibers were two different shades of blue?

Mr. STOMBAUGH. Yes.

Mr. EISENBERG. And they matched two different shades of blue in the shirt out of a total of three different shades of blue?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And you testified before there were about 50 to 100 ranges of shade of green cotton. What about the ranges in shades of blue cotton?

Mr. STOMBAUGH. The same would apply to blue cotton.

Mr. EISENBERG. And the ranges in shades of orange yellow cotton?

Mr. STOMBAUGH. The orange-yellow cotton I have here——

Mr. EISENBERG. 674.

Mr. STOMBAUGH. This is a shade of a yellow cotton fiber, it appears organge yellow under a microscope. Sometimes you get greenish yellow. These will vary, the orange-yellow shade itself might be only two variations in orange yellow, but in a greenish yellow it might be 50 to 100.

Mr. EISENBERG. There was a gray-black cotton fiber in the shirt. Were they uniform between themselves as to color?

Mr. STOMBAUGH. Yes; these were uniform.

Mr. EISENBERG. How many shades of gray, in the gray-black area, can you distinguish?

Mr. STOMBAUGH. The gray-black in itself would be similar to the orange-yellow and would be possibly two or three.

Mr. EISENBERG. And in the black taken as a broader——

Mr. STOMBAUGH. Black taken in itself would go from, all the way from, very grayish-light gray all the way down to dense black.

Mr. EISENBERG. How many different shades can you distinguish?

Mr. STOMBAUGH. Black is different. There are only about 25 or 30 shades, I would say, in black.

Mr. EISENBERG. So you identified the fibers you found on the butt plate as matching the fibers you found in the shirt, not only as to color but as to shades within those colors, out of a range going from 25 in the gray-black or black area to 50 to 100 in the yellow and blue areas?

Mr. STOMBAUGH. That is correct.

Mr. EISENBERG. And degrees of twist were all the same?

Mr. STOMBAUGH. They were the same.

Mr. EISENBERG. Any other characteristics?

Mr. STOMBAUGH. Just type of fibers, they were all cotton fibers.

Mr. EISENBERG. On the basis of these examinations, did you draw a conclusion as to the probability of the cotton fibers found in the butt plate having come from the shirt pictured in Exhibit 673?

Mr. STOMBAUGH. Yes, sir; it was my opinion that these fibers could easily have come from the shirt.

Mr. EISENBERG. Could you go into that in a little more detail, Mr. Stombaugh?

Mr. STOMBAUGH. Yes. Mainly because the fibers or the shirt is composed of point one, cotton, and point two, three basic colors. I found all three colors together on the gun.

Now if the shirt had been composed of 10 or 15 different colors and types of fibers and I only had found 3 of them, then I would feel that I had not found enough, but I found fibers on the gun which I could match with the fibers composing this shirt, so I feel the fibers could easily have come from the shirt.

Mr. EISENBERG. Mr. Stombaugh, I asked you a hypothetical question before concerning whether the rifle could have been a mechanism for transferring fibers from the blanket into the paper bag, and as I recall you said it could have.

Now, is it inconsistent with that answer that no fibers were found on the gun which matched the fibers in the blanket?

Mr. STOMBAUGH. No; because the gun was dusted for fingerprints and any fibers that were loosely adhering to it could have been dusted off.

The only reason, I feel, that these fibers remained on the butt plate is because they were pulled from the fabric by the jagged edge and adhered to the gun and then the fingerprint examiner with his brush, I feel, when brushing and dusting this butt plate, stroked them down into that crevice where they couldn't be knocked off.

In time these fibers would have undoubtedly become dislodged and fallen off the gun.

Mr. EISENBERG. Mr. Stombaugh, is there anything you would like to add to your testimony?

Mr. STOMBAUGH. No, sir; I can think of nothing else.

Mr. DULLES. And you found no other pieces of fabric or other foreign material on the gun?

Mr. STOMBAUGH. Nothing that I could associate with either the blanket or the shirt. I found——

Mr. DULLES. Or the paper bag?

Mr. STOMBAUGH. Or the paper bag; no, sir.

Mr. EISENBERG. Just one further question. You said something like, "It was possible the fibers could have come from the shirt." Could you estimate the degree of probability that the fibers came from the shirt, the fibers in the butt plate?

Mr. STOMBAUGH. Well, this is difficult because we don't know how many different shirts were made out of this same type of fabric, or for that matter how many identical shirts are in existence.

Mr. EISENBERG. Mr. Stombaugh, I gather that, and correct me if I am wrong, that in your area as opposed to the fingerprint area, you prefer to present the facts rather than draw conclusions as to probabilities, is that correct?

Mr. STOMBAUGH. That is correct. I have been asked this question many times. There are some experts who will say well, the chances are 1 in 1,000, this, that, and the other, and everyone who had said that and been brought to our attention we have been able to prove them wrong, insofar as application to our fiber problems is concerned.

Mr. EISENBERG. You mean prove them wrong in terms of their mathematics?

Mr. STOMBAUGH. There is just no way at this time to be able to positively state that a particular small group of fibers came from a particular source, because there just aren't enough microscopic characteristics present in these fibers.

We cannot say, "Yes, these fibers came from this shirt to the exclusion of all other shirts."

Mr. EISENBERG. We appreciate your conservatism, but the Commission, of course, has to make an estimate, and what I am trying to find out is whether your conservatism, whether your conclusions, reflect the inability to draw mathematical determinations or conclusions, or reflect your own doubts?

Mr. STOMBAUGH. No.

Mr. EISENBERG. Can you tell us which that is?

Mr. STOMBAUGH. There is no doubt in my mind that these fibers could have come from this shirt. There is no way, however, to eliminate the possibility of the fibers having come from another identical shirt.

Mr. EISENBERG. Now, in your mind what do you feel about the origin of the fibers you found in the bag?

Mr. STOMBAUGH. I didn't find enough fibers in the bag to form an opinion on those.

Now if I would have found, say 15 or 20 fibers and all 15 or 20 matched the fibers from the blanket, then I could say, "Yes, I feel that these very easily could have come from the blanket." But I didn't. I only found two of the many types.

Mr. EISENBERG. Okay. I have no further questions.

Mr. DULLES. Do you have any further questions?

Mr. MURRAY. No; I have no further questions.

Mr. DULLES. I have no further questions.

Thank you, Mr. Stombaugh, we appreciate your coming.